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CLAMPING SOLUTIONS for Your Workbench & Drill Press

ShopNotes

Vol. 12 www.ShopNotes.com Issue 70

NEW Multi-Purpose Storage Solution

ALSO INSIDE:

TRIM ROUTERS: What You Really Need to Know

TABLE SAW UPGRADE: Build it in a Day

ALL-NEW Sharpening System

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EDITOR'S NOTE

Cutoffs

A few months back, I moved to a different house. Now I'll admit I'm a bit of a pack rat. But it's hard to believe the amount of tools and gear a person (especially a woodworker) can accumulate.

As I was packing up, I realized I'd soon need storage more rugged than what I was using. Now, cardboard boxes are a convenient and inexpensive way to store gear. But after having the bottom drop out of one box and ripping the side on another, I realized this wasn't going to be a long-term solution.

So what's the alternative? Well, it used to be when people wanted to store items or move them from place to place they would use a trunk.

When you think about it, a trunk makes a lot of sense for moving equipment. They have corners reinforced with metal, handles on the ends to make them easy to pick up, and heavy-duty latches to ensure the lid won't pop open.

All of this got me to thinking about making a modern version of an old-fashioned trunk. A storage project I could drop, slam, bang, slide, pull, and even stand on. Something that was really built to take it. And at the same time, built to take with you.

Gear Box - The gear box shown on the front cover is just the ticket. For starters, this project features simple, sturdy, plywood construction. Then we "beefed up" all the corners with aluminum angle.

We also found some interesting hardware. The ends of the gear box are fitted with recessed, spring-loaded handles. And the lid is held down with heavy-duty, metal latches.

Finally, to keep things organized, we added a lift-out tray and a handy, pull-out drawer.

Of course, all of these features add up to a great project for storing woodworking tools. But it works equally well for sports and camping equipment, even car cleaning supplies. It's really up to you.

Whether you're moving your gear across the country, across town, or across the garage, it's the perfect storage solution.

Terry

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www.ShopNotes.com

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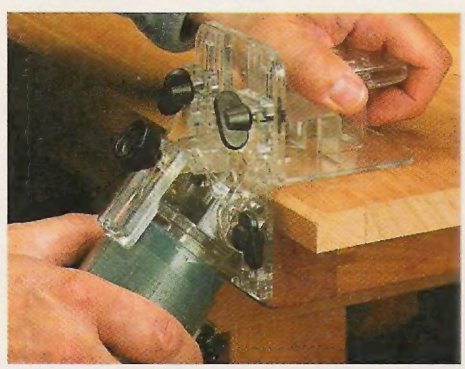

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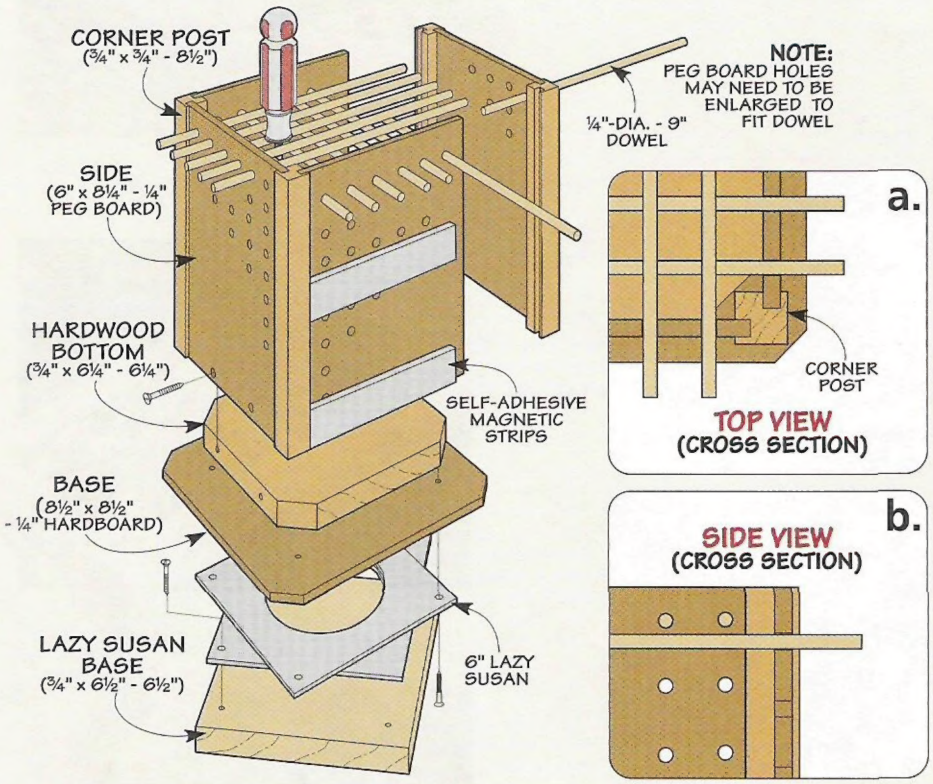
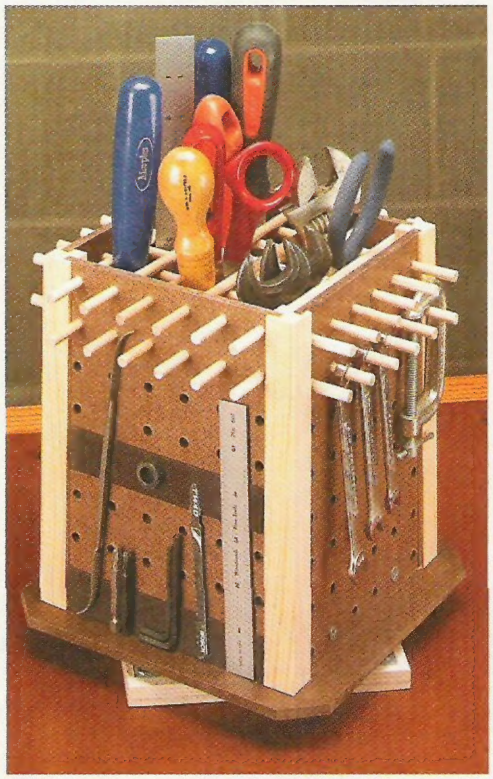
Lazy Susan Tool Caddy





■ I needed a way to keep small hand tools organized, so I built the caddy shown in the photo at right. And to make it even more useful, it's mounted to a lazy Susan. The lazy Susan is sandwiched between a hardwood base and a piece of ¼" hardboard, as in the drawing above.

The caddy is made with pegboard sides held in grooved corner posts. Note: You'll want to make sure the holes in the sides line up with each other. A ¾"-thick bottom screwed to the caddy keeps it square.

To divide the space inside the caddy, push ¼"-dia. dowels through the sides. Note: Depending on the size of the dowels, you may need to enlarge the holes in the sides slightly. The extra length of the dowels makes a great place for hanging tools (like the wrenches shown in the photo above) on the outside of the caddy. Finally, I attached a pair of self-adhesive magnetic strips to the outside to hold the smallest tools like small driver bits, a riffler, or a short, metal rule.

Donna der Kinderen
Arundel, Maine

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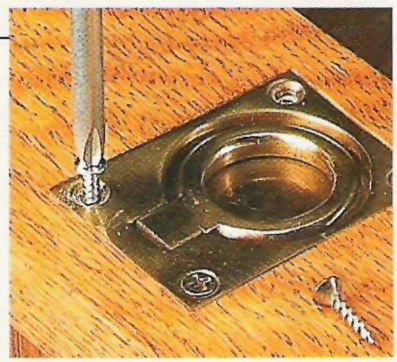
Tapping For Brass Screws

■ Brass hardware really stands out in a project. But nothing's more frustrating than having a soft brass screw snap as you drive it home. Or chewing up the head of the screw with the screwdriver.

To solve the problem, I set the brass screws aside and install steel screws of the same size to cut the threads for the brass screws. Now, the brass screws will go in easily.

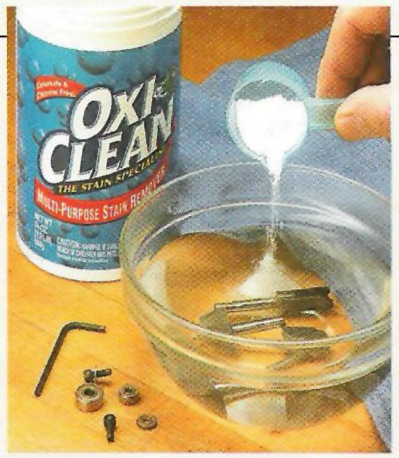
But you can still mess up the head of a brass screw if you have to remove it a few times, like when fitting hinges. So I wait until the very end to install the brass screws.

Harold Ebbletrap
Potter, Wisconsin



Quick Tips

▲ *William Darcy of Austin, TX stores quarter sheets of sandpaper in CD cases. A cutout in the spine makes the sheets easy to remove.*



▲ *To clean router bits and saw blades, **Gene Loose** of Rockford, IL soaks them for a few minutes in Oxiclean dissolved in warm water.*

▲ *Jerry Smith of Bagley, MI ties a red rag to a C-clamp to make a simple warning flag when bringing stock home from the lumber yard.*

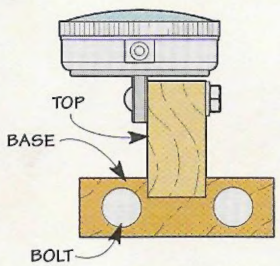
Dial Indicator Squaring Gauge

■ After reading the article on using dial indicators in *ShopNotes* No. 68, I came up with a simple gauge to square up the blade on my table saw.

I built the gauge from some ¾"-thick hardwood scrap. It consists of a base with a groove cut in it to hold a top. Two carriage bolts that act as contact points are attached to one end of the base. The top of the gauge has a hole drilled in it to secure the dial indicator. And then the top is glued in the groove so that the tip of the indicator sticks out past the carriage bolts about ¼".

To use the gauge, raise the blade to its highest setting and position the gauge so that the carriage bolt heads touch the blade. Then "zero" the indicator and move the gauge to the other side of the blade, as shown in the photo below. If the indicator reads zero, the blade is square. If not, you'll need to adjust the saw.

John Green
Royal Oak, Michigan



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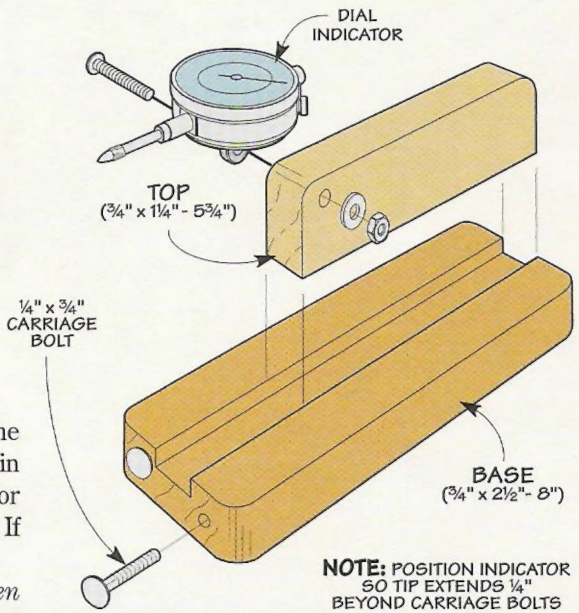

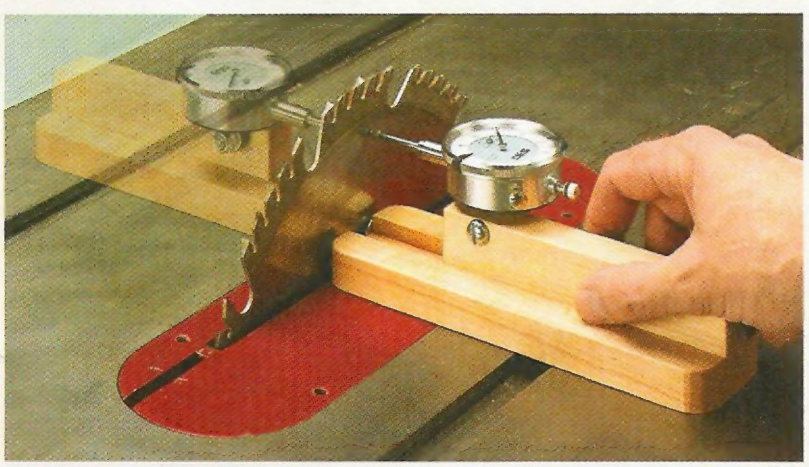

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15 Hold-Down Solutions for your Shop

I once read that the first woodworking "tools" were nothing more than sharp-edged rocks used by early man to fashion simple items out of branches and limbs from trees. If that's true, I'd be willing to bet that the second tool invented was something to hold the workpiece.

Hold-downs may not be the most glamorous tools around. But they are definitely among the most important. It's next to impossible to chop a mortise or rout the edge of a board without holding the workpiece down in some way.

Fortunately, today there are all sorts of hold-downs on the market. Whatever your needs might be, chances are that there is a hold-down out there that is just what you are looking for. So here's a look at some of the hold-downs that we use most often in our shop.

Workbench

A good workbench with a vise is the heart of any woodworking shop. It's invaluable for holding your work while routing, planing, sanding, or making joints. But depending on the size of your workpiece and the task at hand, you can't always use a traditional vise. That's where these workbench "helpers" come in.

Bench Hold-Downs – There are many times when I need to hold a workpiece down to the top of my bench rather than between the jaws of a vise. And even if you have a workbench with a tail vise and dog holes, there are times when the workpiece is too long to be clamped between bench dogs. On these occasions, I like to use bench hold-downs like the ones you see on this page.

There are several different designs of bench hold-downs. But they all work on the same principle, more or less. They mount to the top of the workbench and have an "arm" that reaches out and holds the workpiece down firmly.

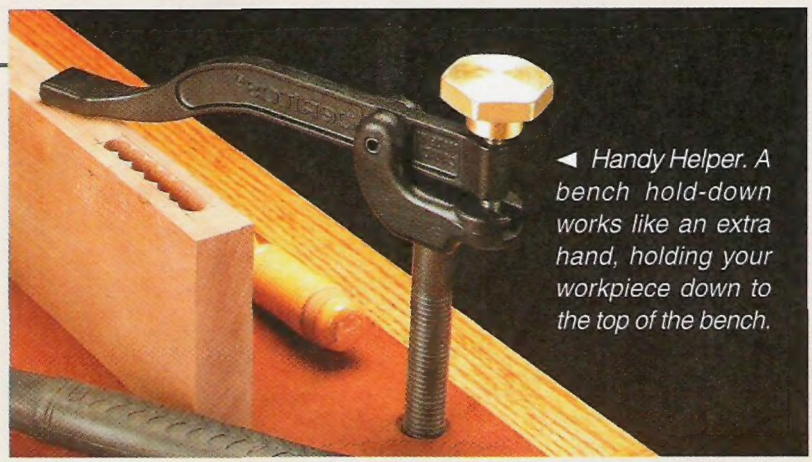
Although all bench hold-downs do the same thing, they go about it in different ways. Some are attached to the bench with hardware, while others simply fit into existing dog holes in the top of the bench. Some use threaded screws for the clamping pressure, others use cams. And one type (lower left photo) relies on wedging action alone. You

Bench Hold-Downs
($10.00-$49.00)
available from:

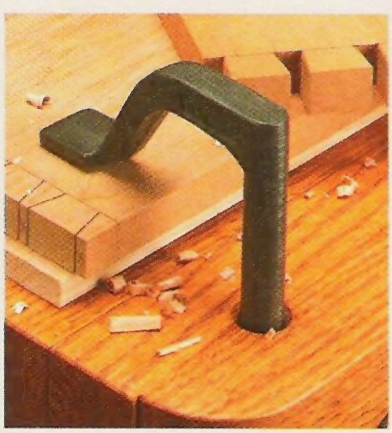
Lee Valley
800-871-8158

Garrett Wade
800-221-2942

Woodcraft
800-225-1153



◀ *Handy Helper. A bench hold-down works like an extra hand, holding your workpiece down to the top of the bench.*



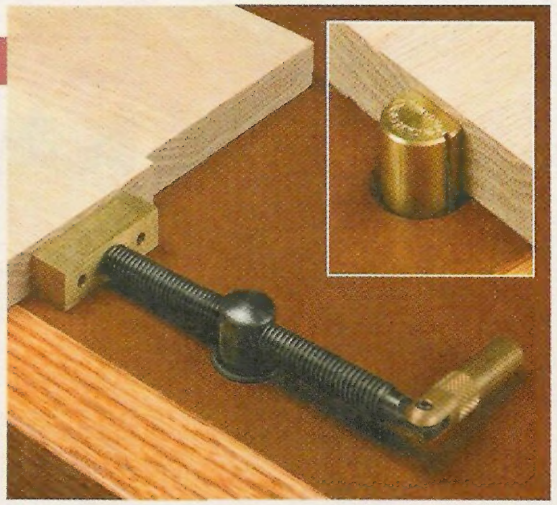
▲ ***Wedge Action.*** *Striking the top of this iron hold-down causes it to wedge against the workpiece.*

▲ ***Screw.*** *This hold-down uses a simple clamp-type screw to hold the workpiece down to the bench.*

▲ ***Cam.*** *These plastic-bodied hold-downs use a cam-locking device to apply pressure to the workpiece.*

simply place the hold-down on top of your workpiece and strike the top with a mallet to wedge the shaft tightly in a dog hole. Another blow on the back of the hold-down releases its grip.

Wonder Pup – As handy as the hold-downs are, they're still no substitute for holding a workpiece between bench dogs. But what if your workbench doesn't have a tail vise? Fortunately, you're not out of luck. A clever little device called the *Wonder Pup* can be used on any bench with $^{3}/_{4}$"-dia. dog holes (see photo at right). The *Wonder Pup* slips right into a dog hole. Then the handle is tightened to clamp the workpiece against a round bench dog (see inset photo).



▲ **Wonder Pup.** *Just like a traditional tail vise, the Wonder Pup works with a bench dog (see inset photo) to clamp a board on top of your bench.*

Wonder Pup & Bench Dog
($19.95 and $7.50) available from:

Lee Valley
800-871-8158

▲ **Bench Stop.** *While it doesn't actually hold the workpiece, a stop is handy for sanding or planing.*

Bench Stop – You don't always need to have a workpiece rigidly clamped in place to work on it. If all you are doing is sanding or planing the surface of a board, a bench stop will work fine. This is just a small device that is mounted into a recess in the top of your bench so that it is flush with the surface. When you want to use the stop, all you have to do is turn a knob and the stop pops up to hold your workpiece (see photo at left).

Bench Stop
(about $6.00) available from:

Lee Valley
800-871-8158

Garrett Wade
800-221-2942

Woodcraft
800-225-1153

Jigs & Accessories

When it comes to hold-downs for shop-made jigs, speed and convenience are usually important issues. I want a hold-down that can be tightened and released quickly and easily. I've found that the hold-downs best suited for this are toggle clamps.

Toggle clamps are quick-release clamps that are available in several sizes and configurations. In-line toggle clamps (like the ones shown in the lower left photo) are used to hold an object against a fence or stop. They're handy for clamping assemblies during glue-ups.

For holding a workpiece down to the top of a jig, I use toggle clamps like the ones shown in the lower right-hand photo. This type has an arm that swings down and locks in place when you push down on the handle.

You can also buy plastic toggle clamps (see photo at right). These are a little lighter and less expensive than the metal versions.

Plastic Toggles. *These tool-friendly plastic toggle clamps work just like their metal counterparts.*

▲ **In-Line.** *These in-line toggle clamps are perfect for holding a door frame in this assembly jig. Each one is capable of applying 300 lbs. of clamping force.*

▲ **Overhead.** *The end of this toggle clamp has a rubber "foot" that grips the workpiece without slipping. It can be adjusted for different thicknesses of stock.*

Toggle Clamps
($8.00-$25.00) available from:

Lee Valley
800-871-8158

Reid Tool Supply Co.
800-253-0421

McFeely's
800-443-7937

Table Saw

Bench hold-downs only have to do one thing well — keep the workpiece from moving. But when you're holding a workpiece down on a table saw, you face a different challenge. Here, the workpiece has to be held firmly against a part of the saw (the table, fence, or miter gauge) but still be free to move past the saw blade.

To do this effectively, there are a couple of different hold-downs for use with table saws. The first type is a miter gauge hold-down, like the ones in the photos on this page.

Miter Gauge Hold-Downs – Although they look a little different (the one in the upper photo is for a *Delta* saw and the one in the lower photo is for a *Sears* saw) both these hold-downs do the same thing. Each one has an adjustable clamp that is positioned over the workpiece and tightened down to hold the board firmly against the miter gauge bar. This way, you don't have to worry about the workpiece "creeping" while you're cutting a miter.

Miter Gauge Hold-Downs
($35.00 - $45.00)
available from:

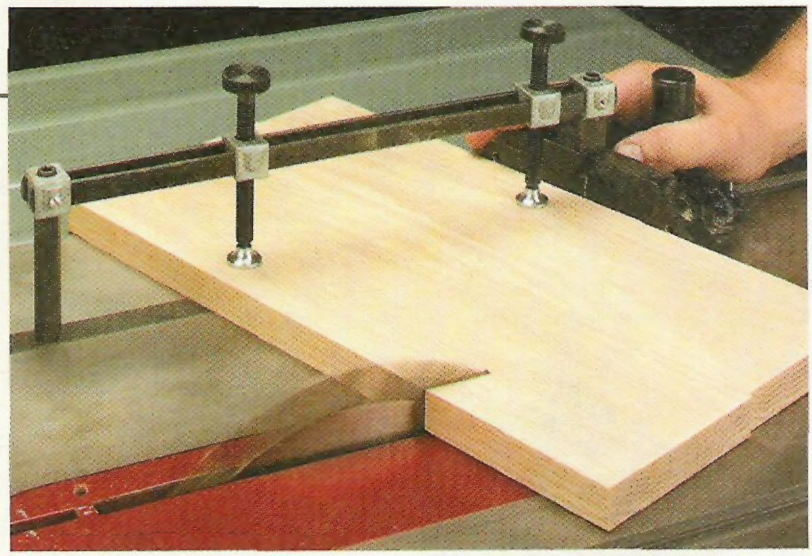
Sears
800-377-7414

Delta
800-223-7278

Aluminum Hold-Down
($4.00-$6.00)
available from:

Rockler
800-233-9359

Woodsmith Store
800-835-5084



▲ *Miter Gauge Hold-Down. The clamp screws on this Delta miter gauge hold-down are adjustable, allowing you to hold either narrow or wide boards for mitering and crosscutting.*

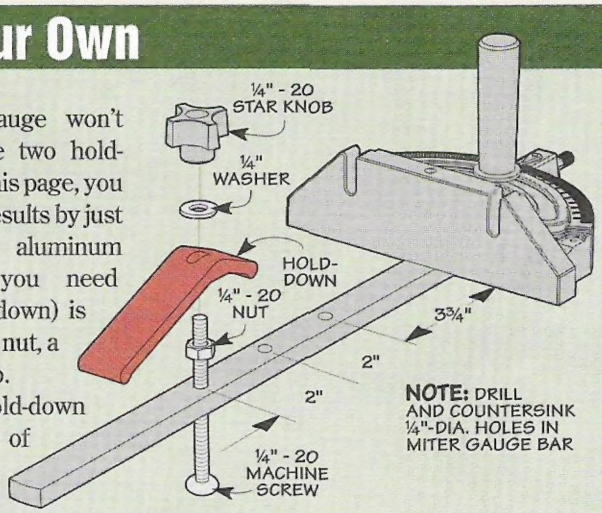
The *Delta* hold-down has a long arm that extends out and allows you to position the clamps several inches away from the miter gauge head. This is useful if you are working with wide boards. The *Craftsman* hold-down is also adjustable, but it doesn't have quite as large a range. And both hold-downs can be quickly removed.

Although these hold-downs are designed to work specifically with *Delta* and *Sears* saws, they do work with some other saws as well. (But it's a good idea to check first before you buy, or at least make sure you can return the hold-down if it doesn't fit your miter gauge.) Another option is to make your own miter gauge

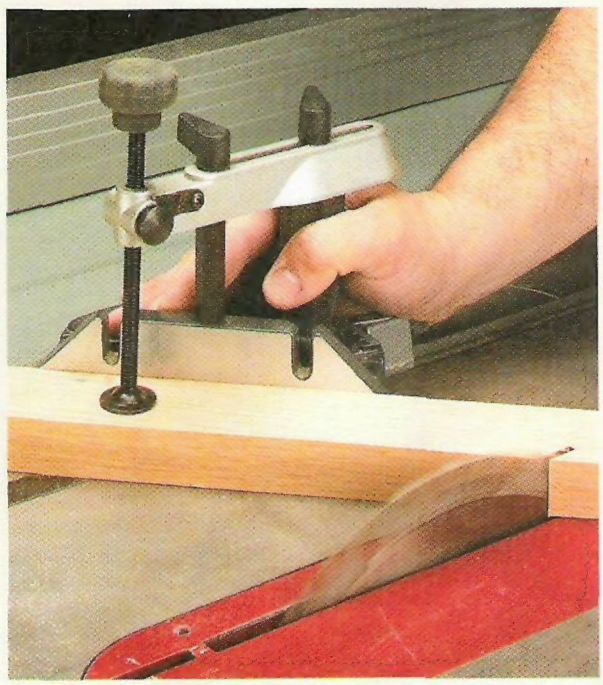
Make Your Own

If your miter gauge won't accept one of the two hold-downs shown on this page, you can get the same results by just adding a simple aluminum hold-down. All you need (besides the hold-down) is a machine screw, a nut, a washer, and a knob.

Adding the hold-down is simply a matter of drilling a few holes in the bar of your miter gauge. The holes are countersunk on the bottom side for the head of the machine screw. The nut holds the screw in place and then the aluminum hold-down is added, followed by the washer and the star knob (see drawing).



▲ *Aluminum Hold-Down. You can add a hold-down like this to your miter gauge.*

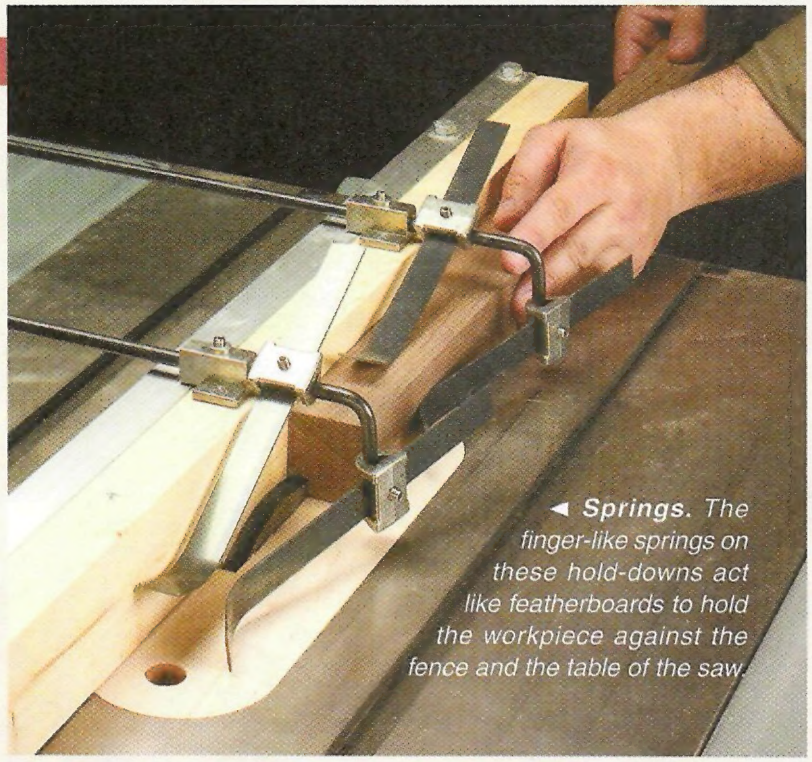


▲ *Small Workpiece Hold-Down. Although it only has one clamp screw and lacks the capacity of the Delta version, this Sears miter gauge hold-down accomplishes the same thing.*

hold-down by following the directions in the box on the opposite page.

Spring Hold-Down – The miter gauge hold-downs are great for crosscuts. But if you use your table saw for cutting rabbets, or for making moldings with a molding head cutter, then you'll want a spring-type hold-down like the one shown in the photo at right.

This hold-down works like a featherboard. It has two pairs of adjustable spring "fingers" that hold the workpiece down *and* against the fence. So all you have to do is worry about pushing the workpiece forward. The hold-downs can be clamped directly to your rip fence or mounted to a separate board that is attached to your rip fence.



◀ **Springs.** *The finger-like springs on these hold-downs act like featherboards to hold the workpiece against the fence and the table of the saw.*

Spring Hold-Downs
($24.99)
available from:

Sears
800-377-7414

Drill Press Vise Clamp
(about $15.00)
available from:

Lee Valley
800-871-8158

Woodsmith Store
800-835-5084

Drill Sargent
($49.99)
available from:

Woodcraft
800-225-1153

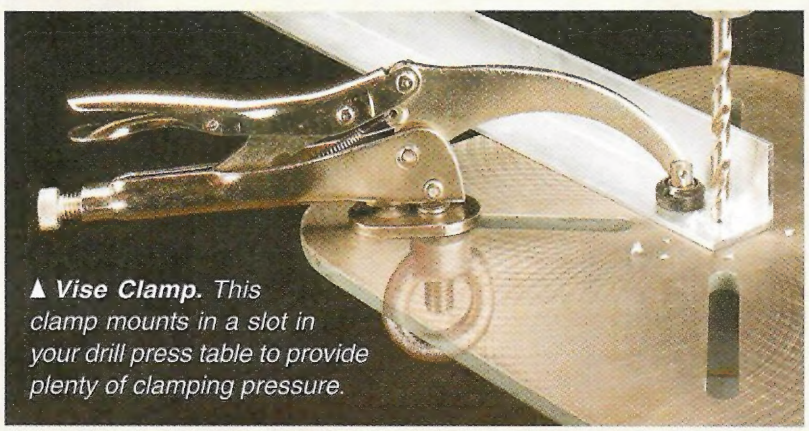
Drill Press

Holding work down on a drill press can get tricky. Usually, the table on a drill press isn't very big, so your workpiece hangs off the edge. And the height of the table often makes it difficult to get good leverage on the workpiece. Fortunately, there are a couple of solutions out there.

Vise Clamp – The first is nothing more than a vise clamp that is designed to mount to the table of your drill press, see photo below. A deep jaw opening and a swiveling pad on the end of the jaw allows it to clamp workpieces of various sizes and thicknesses. This type of hold-down is especially useful when drilling in metal.

Drill Sargent – Another hold-down for the drill press is a relatively new product called the *Drill Sargent* (see photo at right). The *Drill Sargent* is an accessory that mounts to the quill of most drill presses. It features a spring-loaded foot that firmly holds your workpiece down to the table of the drill press. The foot can be adjusted so that it contacts the workpiece just before the drill bit enters the wood. And you can adjust the tension of the spring to give you more or less holding power.

Of course, you can also make your own drill press hold-down. For plans, see the article on page 10.



▲ **Vise Clamp.** *This clamp mounts in a slot in your drill press table to provide plenty of clamping pressure.*

▲ **Drill Sargent.** *This add-on accessory uses a spring-loaded foot to hold down the workpiece. The foot automatically lifts as you raise the drill bit out of the hole.*

Drill Press Hold-Down

This simple drill press accessory has an iron-fisted grip that can hold down just about any workpiece.

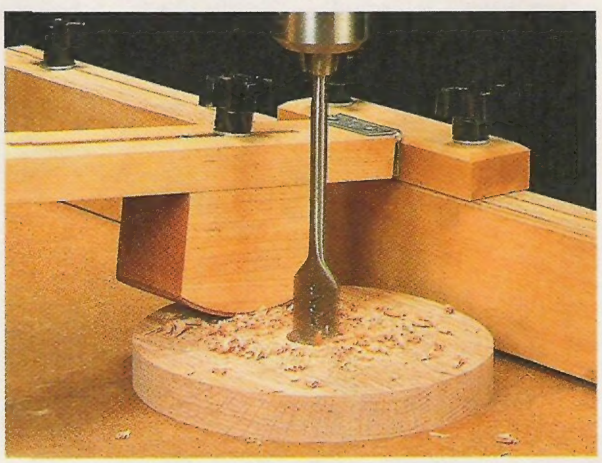
A drill press can be one of the simplest tools to use. You just hold the workpiece in place, turn it on, and pull down on the handle, right? Well, it's not always that easy.

If you've ever had to drill a hole near the end of a long board, you know how difficult it is to hold the workpiece flat while the other end hangs off the drill press table. Or maybe you've felt somewhat nervous while holding onto a small workpiece because your hands were just a *little* too close to the drill bit? And how about drilling a hole in a dowel or odd-shaped workpiece? You get the picture. Using a drill press isn't too complicated, but holding on to the workpiece can be a challenge at times. Which is why we came up with this handy drill press hold-down.

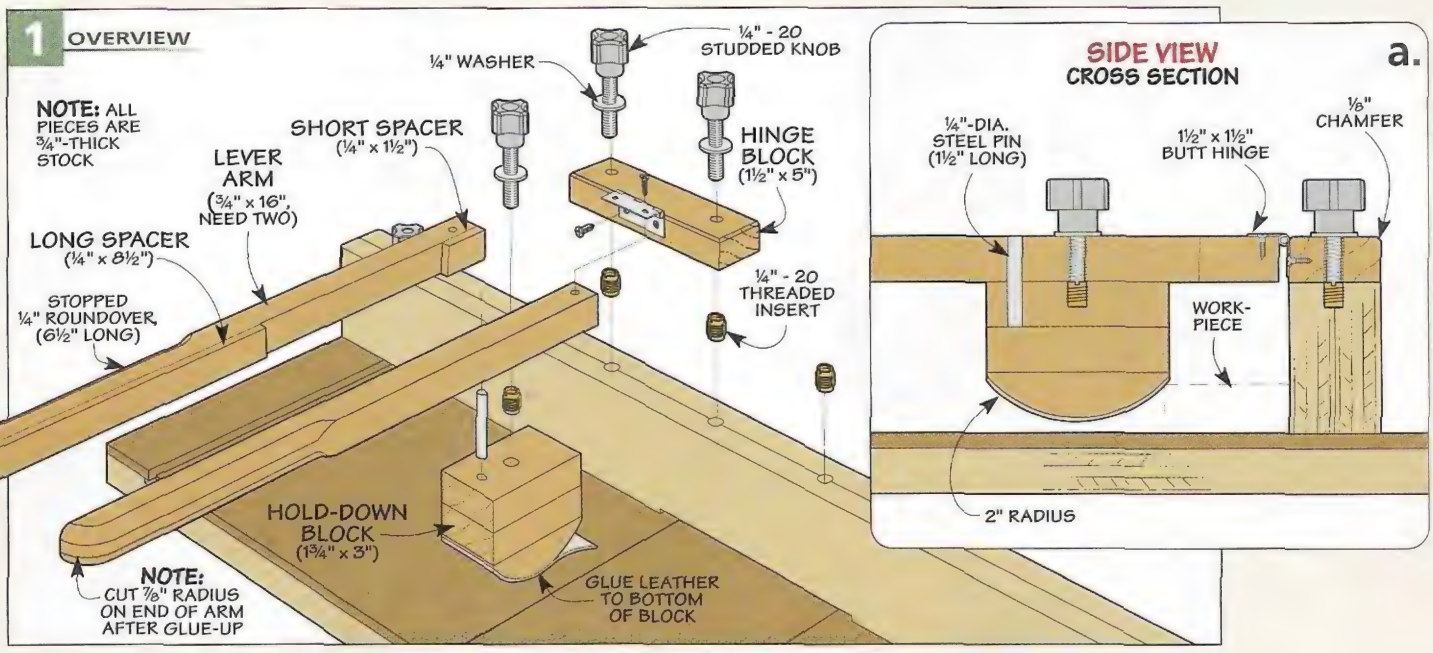
This hold-down is really nothing more than a hinged arm that attaches to the fence of your drill press. At first glance, it looks like one of those devices for crushing aluminum cans. And actually it works on the same principle — leverage. Because the arm acts as a lever, it applies a surprising amount of force to hold down a workpiece — much more than you can get from holding a piece by hand.

Speed – The other thing that I like about this hold-down is that it's

▲ **Dowels.** *The convex shape of the bottom of the hold-down block allows you to firmly grip dowels or other odd-shaped workpieces while drilling holes.*



▲ **Small Workpieces.** *The hold-down easily holds small workpieces, allowing you to keep your hands a safe distance from the drill bit.*



so quick and easy to operate. There aren't any clamps to tighten or screw down. Just lift up the lever arm, slide your workpiece into position and swing the arm back down. It's great when you have a lot of holes to drill.

If you take a look at Figure 1, you can see that the drill press hold-down is made up of three basic parts — a lever arm, an adjustable hold-down block, and a hinge block. All three pieces are made out of ¾"-thick hardwood.

Lever Arm – I started by making the lever arm. As you can see in Figure 1, the arm is glued up out of two halves, with a couple of narrow (¼") spacers in between. This creates a slot down the center of the arm for the adjustable hold-down block that will be added later.

After gluing up the arm, I rounded off the handle end on the band saw and sanded it smooth. Then I eased the edges slightly with a router to create a nice, comfortable grip.

Hold-Down Block – With the lever arm complete, the next step is to make the adjustable hold-down block. This block is glued up out of three layers of hardwood. Then I installed a threaded insert in the top for a star knob that will be used to hold the block to the arm. I also drilled a hole in the top of the block and epoxied a steel pin in place. The pin fits in the slot in the arm and prevents the block from twisting out of alignment with the lever arm.

To complete the hold-down block, just round off the bottom edge. This allows the block to make good contact with workpieces of all shapes and thicknesses. And finally, to protect the surface of the workpiece from dents or marks, I glued a piece of leather to the bottom of the block.

Hinge Block – The last piece to make is the hinge block, and it's pretty simple. It's just a small block of wood with chamfered edges all along the top. A small hinge is then screwed to both the block and the end of the lever arm.

When it comes to mounting the hinge block to your drill press fence, you have a couple of choices. The simplest way is to use knobs and threaded inserts, like you see in Figure 1. (By installing two sets of inserts, you can mount the hold-down in a couple of different spots.)

The other mounting option is to use flange bolts and knobs along with a T-track installed in the top of your drill press fence, as you see in the photo below. This gives you a little more flexibility in positioning the hold-down.

▲ ***T-Track.*** *By mounting the hold-down in a T-track installed on the top of your drill press fence, you can quickly position the hold-down anywhere it's convenient. Or remove it altogether at a moment's notice.*

Workbench Board Jack

A workbench with a good vise is indispensible for holding workpieces while planing, routing, or sanding. But at times, a vise alone isn't enough to hold the workpiece securely. In these cases, you need a helping hand. That's where this board jack comes in. It acts as an extra person, holding up the end of a long board that is clamped in a face vise (see photo at left).

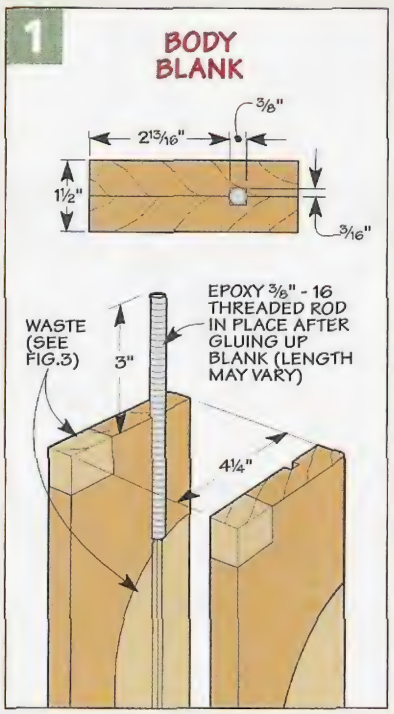
Board Jack – Most board jacks slide back and forth on rails along the front of a workbench. But this one is designed to mount in one of the dog holes along the front of your bench. Then when you're done using it, you can just remove it and store it out of the way.

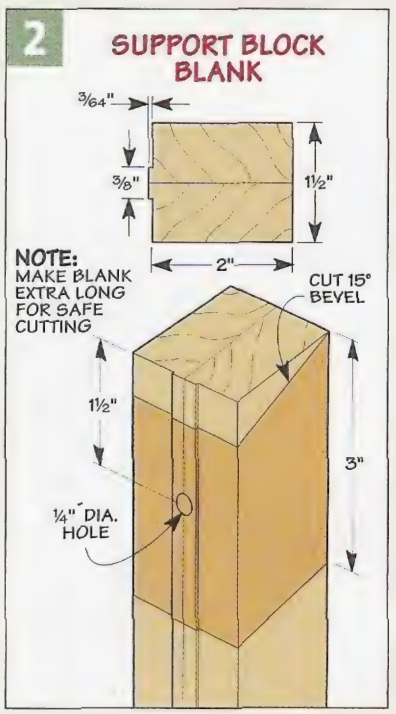
Shop Note: This board jack is designed to be used with the workbench that appeared in issue No. 65. If you are building it for a different bench, you may have to make some modifications to the design.

The board jack is made up of two main parts. The body is a long, narrow piece that hangs down from the top of the workbench. It's held in place by a wing nut and threaded rod. A notch at the top of the body allows the board jack to fit around the front apron of the bench. And the bottom is cut away so the jack rests against the stretcher of the bench.

Body – As you can see in Figure 1, the blank for the body is glued up from two pieces of ¾"-thick stock. Before gluing the pieces together, however, you'll need to cut a groove in each one to hold a piece of threaded rod. This rod will be epoxied into place later. Shop Note: The distance between the center of this groove and the front of the blank should be the same as the distance between the front of your bench top and the center of the dog holes.

After gluing up the blank, you can cut a clearance notch at one end for



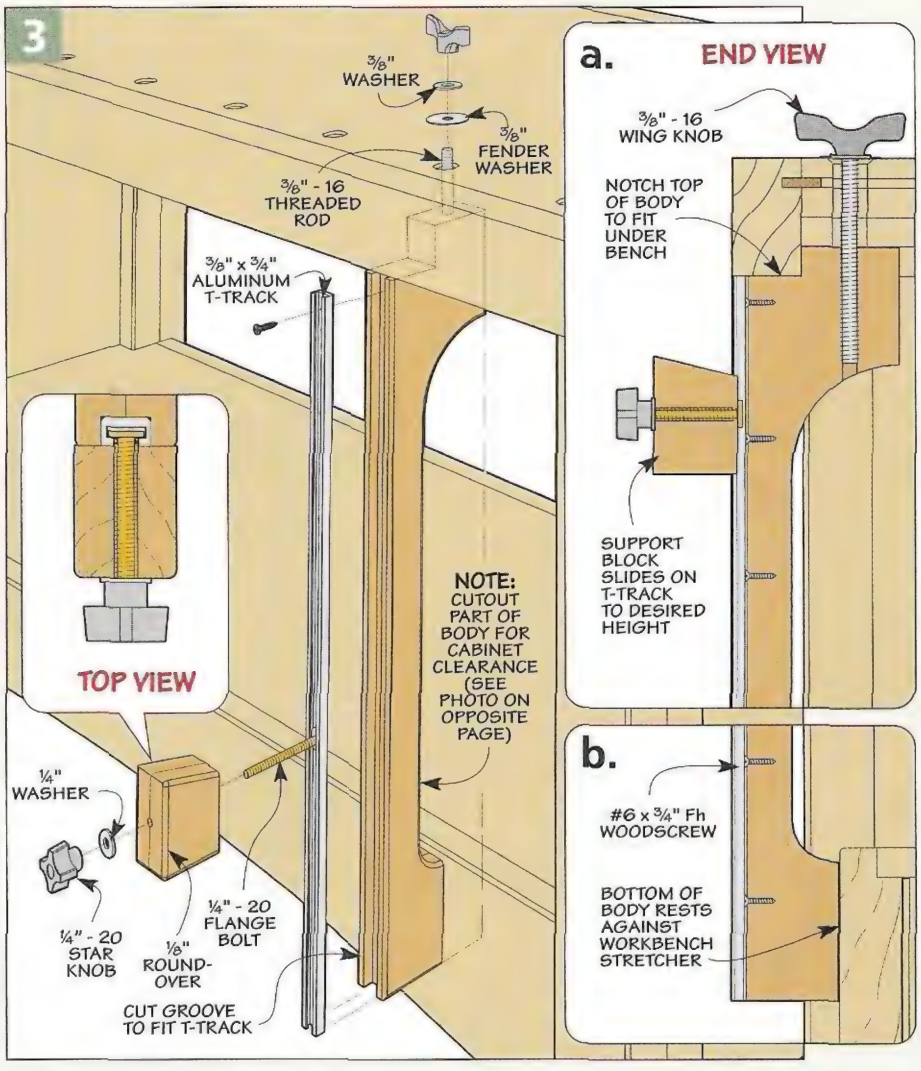


the front apron of your workbench (Figure 3a). Then a groove is cut along the front of the blank and a piece of T-track is installed (Figure 3). This will be used to hold a support block that is added later.

Finally, I cut away the back edge of the body. This allows the board jack to rest against the stretcher of the bench. And if you have storage under your bench, it also creates clearance for any knobs or drawer pulls, see photo at left. Then the edges can be rounded over and the threaded rod can be epoxied into place.

Support Block – The second part of the board jack is just a simple block that slides up and down in the T-track and supports the end of the workpiece. Like the body, this block is also glued up out of two layers of ¾"-thick stock (Figure 2). A small tongue is cut on the back edge to allow it to fit in the T-track. Then a hole is drilled through the block for a flange bolt. Finally, the top of the block is beveled to keep your workpiece from sliding off.

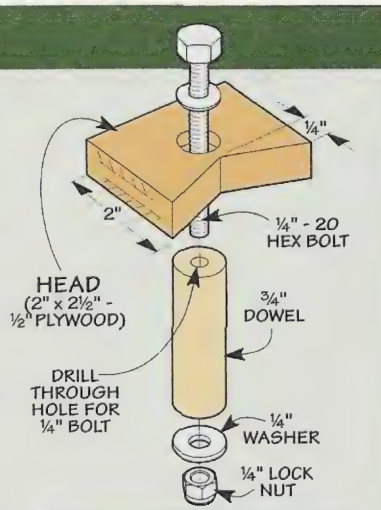
Bench Dog – In addition to the board jack, I also came up with a simple shop-made bench dog for holding round workpieces on top of the bench (see box below).

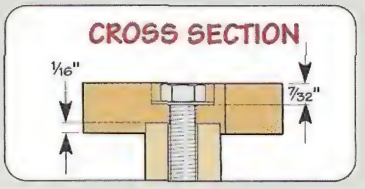


Shop-Made Bench Dogs

Another bench accessory that I came up with are these bench dogs to hold round pieces. There's not really much to this one. The head of each dog is just a shaped block of ½" plywood that is counterbored to accept a short length of ¾"-dia. dowel, see drawing. The dowel fits into the dog holes of your bench. A shallow "V" is cut in the face of the head to allow it to grip round workpieces.

To help strengthen the bench dog, a hex bolt passes all the way through the head and the dowel. So you'll have to drill a hole through the length of the dowel. And you'll also need to drill a counterbore in the top of the dog for the head of the bolt and a washer. Finally, a washer and lock nut are used to hold everything together.





Six Solutions for Drilling & Driving

Drilling and driving a screw sounds like a simple two-step process — just drill a hole, then drive the screw in place. But there's actually a lot more than that going on.

Drilling – For starters, the screw typically has to join two pieces. To do this effectively, a standard woodscrew needs to pass through a shank hole in the top piece that prevents the threads of the screw from grabbing and causing a gap between the two pieces. The head of the screw also needs to fit into a countersink so it's perfectly flush.

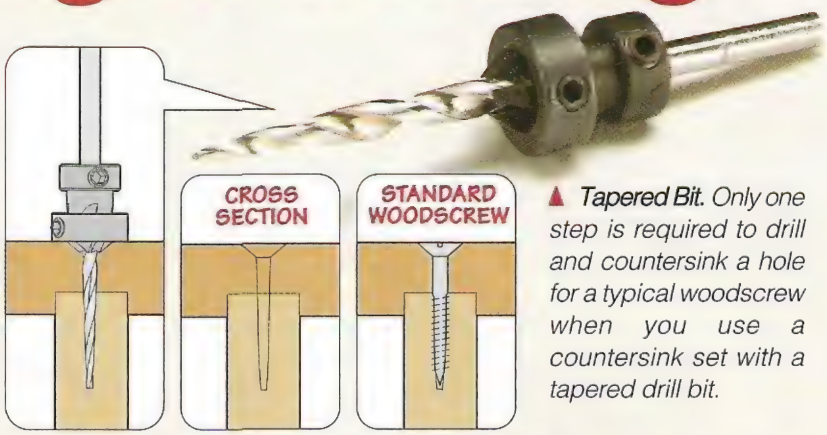
In the second piece, the threads enter a smaller pilot hole that's sized to allow the threads to bite and hold the two pieces together.

Complicating this process even more are modern woodscrews that aren't tapered. Instead they're straighter, with a narrower shank that matches the root of the screw.

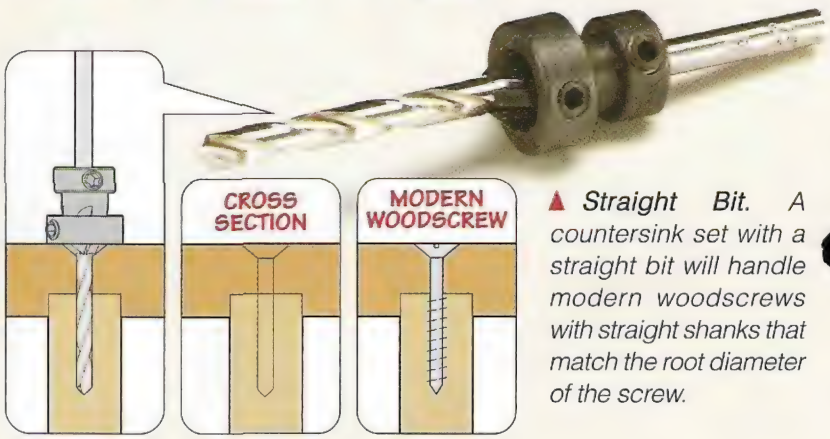
I know. All this makes drilling and driving a screw sound more like a multi-step process and a lot of work. But it doesn't have to be.

Countersink Bits – In our shop we use a set of countersink bits that makes drilling a hole for a woodscrew a simple, one-step process.

The countersink bits you see above allow you to drill a shank hole, pilot hole, and a countersink in one shot — whether you're using a typical tapered woodscrew or a more modern woodscrew that's straight. (If you'd like, you can even counterbore the hole to set the head of either type of screw below the surface of the workpiece.)



▲ *Tapered Bit. Only one step is required to drill and countersink a hole for a typical woodscrew when you use a countersink set with a tapered drill bit.*

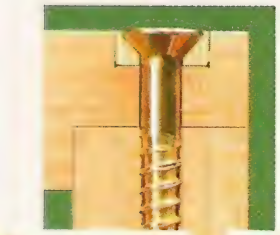


▲ *Straight Bit. A countersink set with a straight bit will handle modern woodscrews with straight shanks that match the root diameter of the screw.*

I prefer *Fuller* countersinks and use them on just about every project I build. Each countersink bit has three pieces. The first is a tapered (or straight) drill bit that matches the size of the screw you're using. So you'll need a countersink bit for each size (#6, #8, etc.) of screw you use.

Attached to the bit is a countersink that slides up or down the bit. Using an Allen wrench, you can lock the countersink in any position to match the length of the screw.

Finally, there's a stop collar that fits over the countersink and locks down in a similar manner. The collar limits the depth of the countersink so the head of the screw ends up perfectly flush with the surface of the workpiece. Or you can adjust it to drill a counterbore so you can cover the head of the screw with a plug.



Countersunk Washers

One of the more interesting products I've run across lately is the brass countersunk washers shown at right. The washers fit into counterbores drilled in the face of one of the workpieces. (You still need to drill a shank and pilot hole for the screw.)

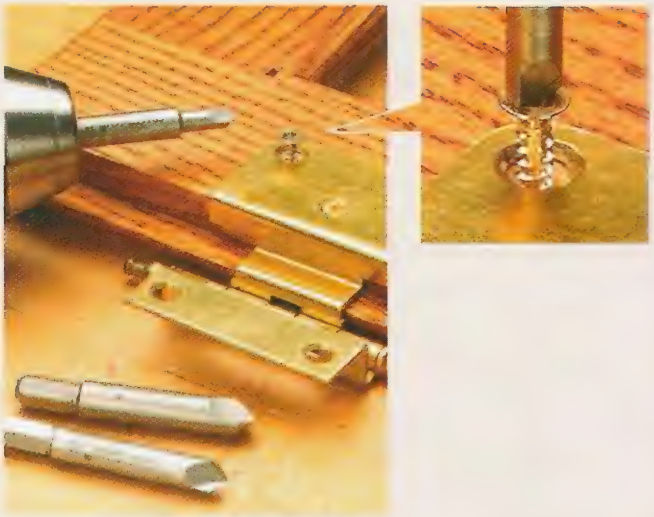
As you drive the screw in place, the washer transfers the splitting effect normally created by the head of the screw. Instead of "wedging" the wood apart, the force goes straight down, like you see in the inset photo at left. This eliminates any possibility of splitting along the end of the workpiece. For sources, refer to page 35.

Countersink bits handle most of my drilling needs with ease. But there are some cases where even if you have the right drill bit, you can't get it where you want it because there isn't enough clearance.

Right-Angled Drive – In that situation, a right-angled drive attachment comes in really handy.

As you can see in the photo at right, the drill bit fits into the drive which is mounted to the drill chuck. This creates more clearance, allowing you to get to the inside of a drawer or cabinet that you otherwise couldn't get into.

▲ *Drill at an Angle. A right-angled drive attachment is invaluable when you need to drill or drive a screw in a tight spot.*



▲ *Screw Removers. Remove a damaged screw with ease with a set of carbide screw removers.*

Removing Screws – No matter how much time you spend preparing the workpiece and drilling a hole for the screw, things don't always work out right once you install it.

Sometimes as you drive the screw in, the drive bit slips and messes up the head of the screw, especially if you're working with brass screws. The screw is either not in all the way or, even if it is, the messed-up head just doesn't look very good.

It's best to replace the screw with a new one, but getting the old one out can be a problem. That's why I keep a set of screw removers handy, like the *Sears* set shown in the right photo above.

The remover slips into the chuck just like a drill bit. But instead of driving the remover into the head of the screw, you run the drill slowly in reverse and apply pressure to the head of the screw. The remover "digs" into the head and turns the screw out with ease, as you can see in the inset photo.

New Products – I've always liked using magnetic bit holders that hold a screw in place on the drive bit when you need an extra hand. But I bought a set the other day that works better than most. To learn more about them, take a look at the box at right.

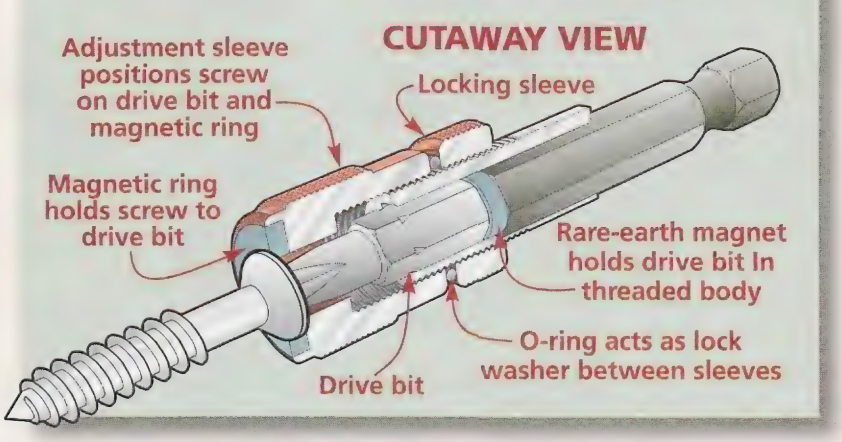
And one last thing. If you've ever split the end of a workpiece driving in that last screw, you'll appreciate another new product — countersunk brass washers. You can read more about them in the box on page 14.

There's no secret to successfully installing traditional or modern woodscrews. The right tools and techniques make drilling and driving screws into a project easier, faster, and more accurate.

Magnetic Bit Holders

Magnetic bit holders are nothing new. What's different about the ones at right is that instead of a single magnet to hold both the drive bit and screw, there are two (see drawing). A magnet in the body holds the drive bit in place while a second "ring" magnet in the tip adds extra holding power to keep the screw in place.

Another feature is the two-part body. You can adjust this to ensure the screw is fully-seated on the drive bit *and* supported around the head. Finally, two versions are available. One (upper photo) has a flat magnet at the tip for flathead screws and the other (lower photo) is dished to accept round or panhead screws. See page 35 for sources.



Shop-Built Gear Box

Rugged plywood construction reinforced with aluminum angle means this gear box can handle any storage task — in or out of the shop.

There are two things there never seem to be enough of in a workshop — tools and storage.

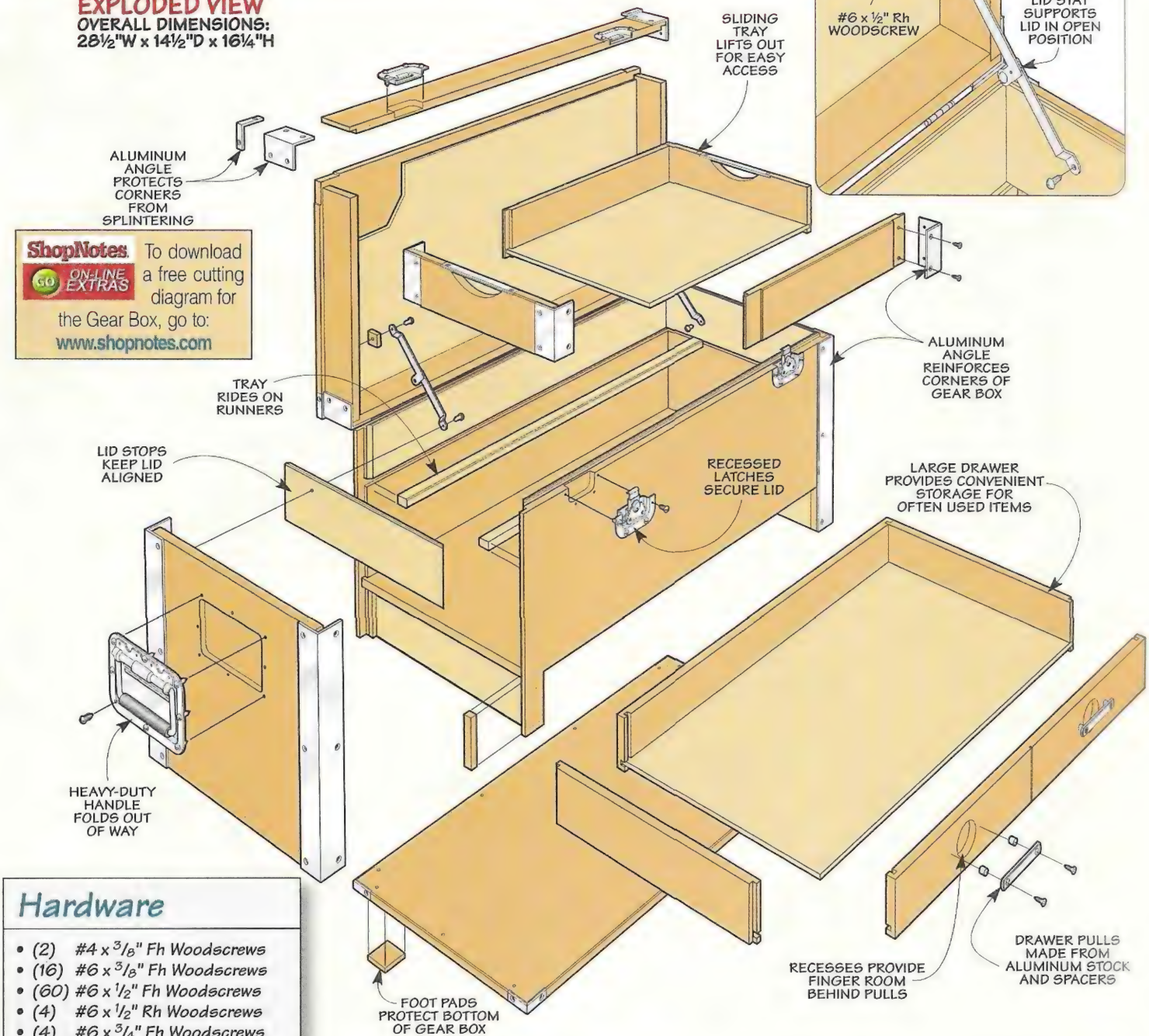
Now I can't help with the tools, but the shop-built gear box shown above will go a long way towards solving the storage problem — whether you're storing tools, camping gear, or car supplies (see back cover).

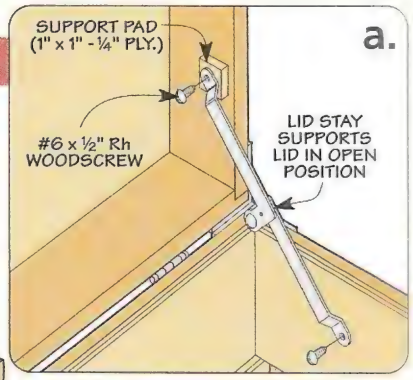
The gear box starts out as a simple plywood box. But the hardware and aluminum angle are what make this gear box something you'll never have to baby. The aluminum angle reinforces all the corners to ensure the gear box will hold up no matter what you're storing (or where you're storing it). And to match the rugged construction, the design incorporates heavy-duty handles and matching latches.

Worried about keeping things organized? Don't be. A large storage drawer in the bottom of the case and a sliding tray inside the main case keep often-used items close at hand. You can even incorporate storage inside the lid with some custom-made holders. (For more on this, refer to the box on page 23.)

EXPLODED VIEW

OVERALL DIMENSIONS:
28½"W x 14½"D x 16¼"H





ShopNotes ON-LINE EXTRAS To download a free cutting diagram for the Gear Box, go to: www.shopnotes.com

Hardware

- (2) #4 x 3/8" Fh Woodscrews
- (16) #6 x 3/8" Fh Woodscrews
- (60) #6 x 1/2" Fh Woodscrews
- (4) #6 x 1/2" Rh Woodscrews
- (4) #6 x 3/4" Fh Woodscrews
- (10) #6 x 1 1/2" Fh Woodscrews
- (1) 1 1/2" x 1 1/2" x 8' Aluminum Angle (1/8" thick)
- (2) 1/2" Rare-Earth Magnets
- (2) 5/8" Magnet Washers
- (2) 5/8" Magnet Cups
- (2) Lid Stays
- (4) 5/16" x 1/4" Metal Spacers
- (2) Handles w/(16) #10 x 1/2" Ph Sheet Metal Screws
- (2) Latches w/(16) #8 x 1/2" Ph Sheet Metal Screws
- (2) Hinges w/(10) #6 x 1/2" Ovalhead Woodscrews

Note: All aluminum parts cut from the 8' piece of angle listed above.

Materials

Lid & Case

A	Front/Back (2)	15 1/8 x 28 - 1/2 Ply.
B	Sides (2)	15 1/8 x 13 1/2 - 1/2 Ply.
C	Divider (1)	13 1/2 x 27 1/2 - 1/2 Ply.
D	Spacers (4)	3/8 x 3 - 1/2 Ply.
E	Drawer Fillers (2)	3 x 13 - 1/2 Ply.
F	Tray Runners (2)	3/4 x 27 - 1/2 Ply.
G	Lid Top/Bottom (2)	14 1/2 x 28 1/2 - 1/2 Ply.
H	Foot Pads (4)	1 1/2 x 1 1/2 - 1/4 Ply.
I	Lid Liner (1)	13 x 27 - 1/4 Ply.
J	Lid Stop	3 x 82 (rgh.) - 1/4 Ply.

Drawer Assembly

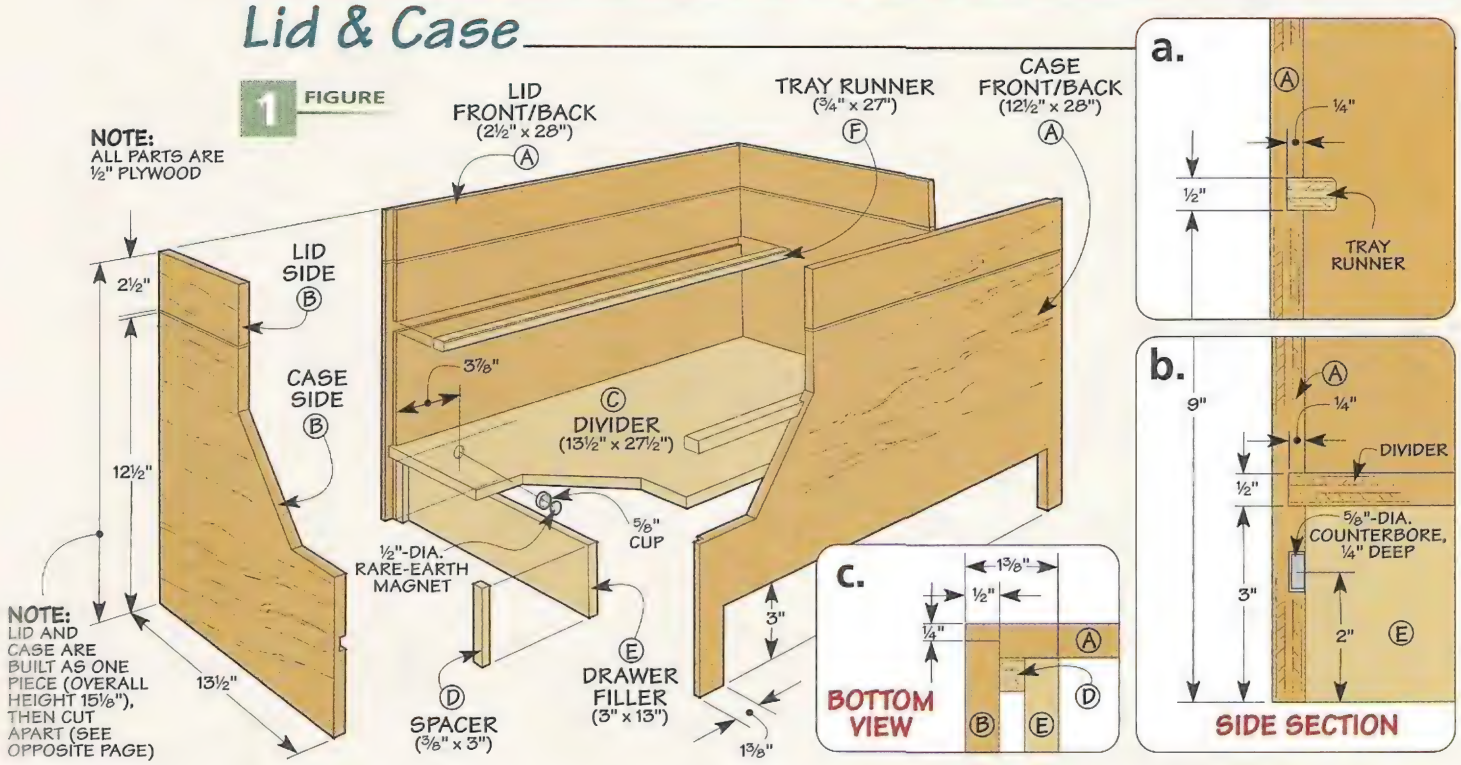
K	Front/Back (2)	2 15/16 x 25 3/16 - 1/2 Ply.
L	Sides (2)	2 15/16 x 13 1/2 - 1/2 Ply.
M	Bottom (1)	13 x 24 11/16 - 1/4 Ply.

Tray Assembly

N	Ends (2)	3 x 11 15/16 - 1/2 Ply.
O	Sides (2)	3 x 16 - 1/2 Ply.
P	Bottom (1)	11 15/16 x 15 1/2 - 1/4 Ply.

Note: You'll need one sheet of 1/2" Baltic birch plywood and a half sheet of 1/4" Baltic birch plywood for the gear box.

Lid & Case



As you can see in Figure 1, the gear box starts out as a tall plywood box. Creating the lid is just a matter of cutting a piece off the top, but you'll learn more about that later.

The thing to keep in mind as you size the parts is to cut the *front/back (A)* and *sides (B)* $\frac{1}{8}$" wider (taller) to account for the saw kerf (Figure 1).

Joinery – Once the parts are sized, you can turn your attention to the joinery. The sides fit into rabbets cut in the ends of the front and back, as in Figures 1 and 1c. And grooves cut in only the front and back accept runners that support the sliding tray (Figure 1a). Finally, the divider that forms the top of the drawer compartment rests in a groove near the lower edge (Figure 1b).

Before you can glue up the case, there are a couple things to do. The first one is to drill a pair of counterbores in the back of the case for a cup and magnet that hold the drawer closed as you move the case around (Figures 1 and 1b). Note: The cups are glued in place with epoxy.

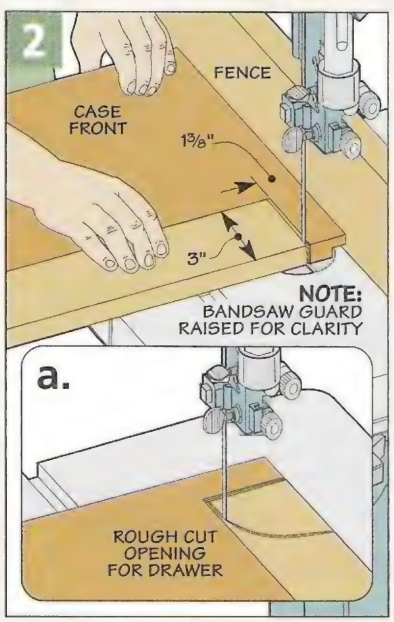
Drawer Opening – The next step is to rough cut the opening for the drawer in the front of the case. I used a band saw to do this, as you can see in Figures 2 and 2a. You don't need to worry about having a nice, straight cut along the top edge just yet. Trimming this will be easy once the case is assembled.

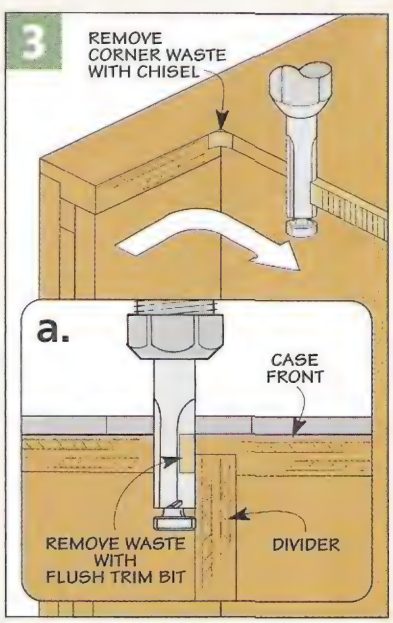
Assembly – After sizing the *divider (C)*, you can glue the case together and then complete the drawer compartment. This is just a matter of adding the *spacers (D)* and the *drawer fillers (E)* that fit flush with the inside edge of the drawer opening, as in Figures 1 and 1c.

The fillers also provides support so you can trim the rough opening smooth using a hand-held router and flush trim bit, as in Figures 3 and 3a. (I used a chisel to clean up the corners.)

Once the assembly is complete, you can cut the lid from the box. The article on the opposite page provides step-by-step instructions for this.

Finally, cut a pair of *tray runners (F)* to size and glue them in place.





A Perfect-fitting Lid and Case

One of the biggest challenges to making a lidded box is matching the lid to the case. Creating a smooth, even fit by building two separate assemblies can be tough.

So instead of doing that, I used a different approach to get a perfect match. By building a single tall box, you can create the lid simply by cutting off the top of the box, as you can see in the photo at right. This ensures that the lid and case will be an exact fit — for any kind of box you might build.

Use the Table Saw – As the photo shows, a table saw makes quick work of cutting the lid from the box. But there's one small problem. If you cut completely through the box on all four sides, the kerf tends to pinch around the saw blade during the last cut.

Cut Through Long Sides – To prevent this, it's a good idea to *not* cut completely through all four sides. Instead, make the first two cuts completely through the longest sides. In the case of the gear box, that would be the front and back of the case, as illustrated in Figure 1a.

Partially Cut Short Sides – The next step is to lower the saw blade so it's slightly *less* ($^1/_{16}$") than the thickness of the sides of the case, like you see in Figures 1 and 1b.

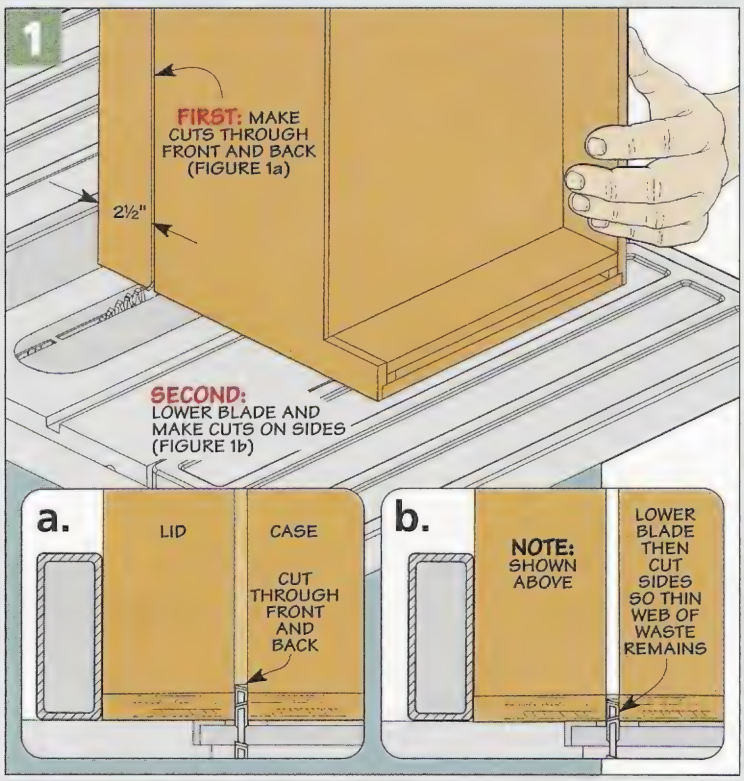
After you make a pass across each short side of the case to "score" them, you'll leave a thin web. This web holds the box together and prevents the kerf from pinching against the saw blade.

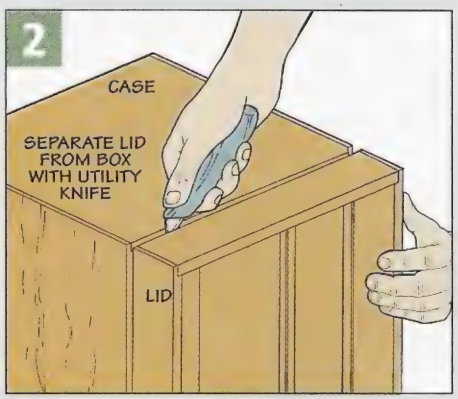
With the cuts complete, you can separate the lid from the case by making a series of light passes with a utility knife, as shown in Figure 2. (A fine-toothed saw will also work.)

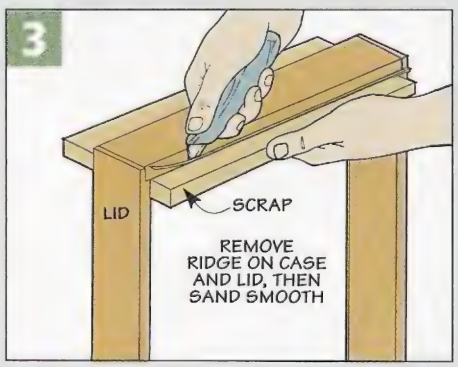
Remove Waste – After cutting through the web holding the lid and case together, you may notice a little ridge along the inside edges of both pieces. The utility knife and a wide piece of scrap make quick work of cleaning those up. You can see this illustrated in Figure 3.

Finally, sand the edges smooth, making sure to keep the edges straight and square.

▲ *Separating a Lid from a Case. After cutting completely through the long sides of the case, lower the saw blade and "score" the short sides to almost separate the lid from the case.*







Lid Top, Bottom, & Trim

At this point, you're ready to start beefing up the gear box to make it stand up to rugged use. In Figure 4 you can see that this involves adding aluminum angle to strengthen and protect the exposed corners along with some heavy-duty hardware.

Latch & Handle Recesses – To create a low profile, the latches and handles (refer to page 23) for the gear box fit into recesses. For the handles in the sides of the case, you can simply lay out the openings and rout the recesses, as in Figure 5.

But the two-part latches require a recess in *both* the lid and case. To ensure a good fit, it's best to clamp the pieces together and then rout the recess, as shown in Figure 5a.

Lid Top & Bottom – Once the recesses are routed, you can turn your attention to the top and bottom of the gear box. The *lid top* and *bottom (G)* start out as identical 1/2" plywood panels, as in Figure 4. To provide an "overhang" around the outside faces of the gear box they're 1/2" wider and longer than the box.

To help reinforce the corners of the top and bottom, I added some corner protectors made from aluminum angle. (For more on working with aluminum, see opposite page.)

The protectors fit into notches cut in the corners of the lid top and bottom, as in Figures 6 and 6a. After screwing the corner protectors in place, I used a chamfer bit to ease the top edge. And after gluing on a set of 1/4" plywood *foot pads (H)*, I screwed the bottom in place (Figure 4).

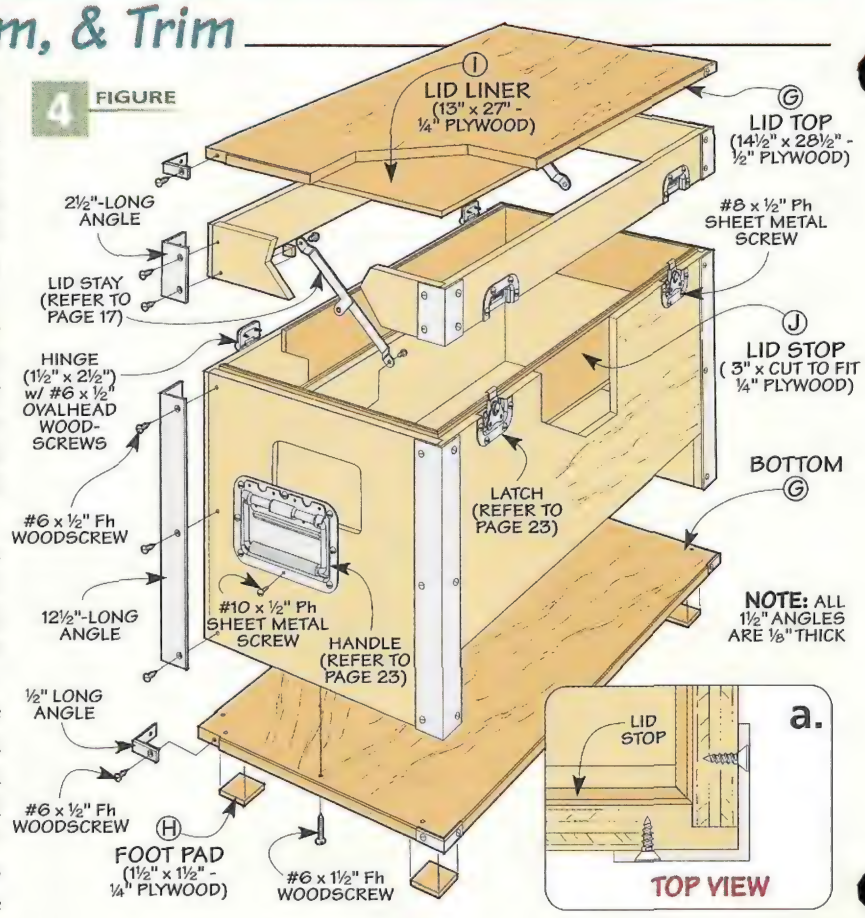
Before adding the top, I glued a 1/4" plywood *lid liner (I)* to the underside. The liner serves two purposes. First, it "beefs up" the top. And second, it forms a rabbet that provides a strong gluing joint.

Now you can screw the aluminum angles to the corners of the lid and case, as shown in Figure 4.

Lid Stop – Next, you'll need to make up some *lid stop (J)* for the inside of the case. The stop creates a lip around the opening, aligning the lid when it is closed. The stop is cut from 1/4" plywood that's been rounded over along the top edge. Each piece is mitered to length and then glued in place.

Install Hardware – Now you can set the lid in place and add the latches, handles, and hinges (refer to page 23). Finally, to hold the lid upright, you can add the lid stays shown in Figure 4. Note: To position the top end of each stay properly, you'll need to glue small wood spacers to the inside of the lid.

FIGURE 4



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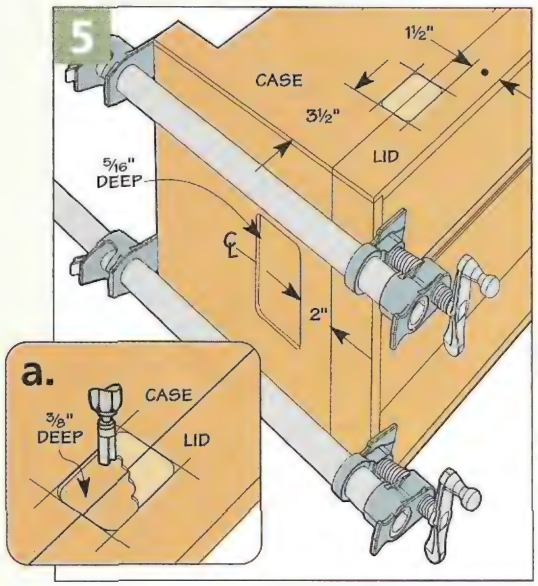

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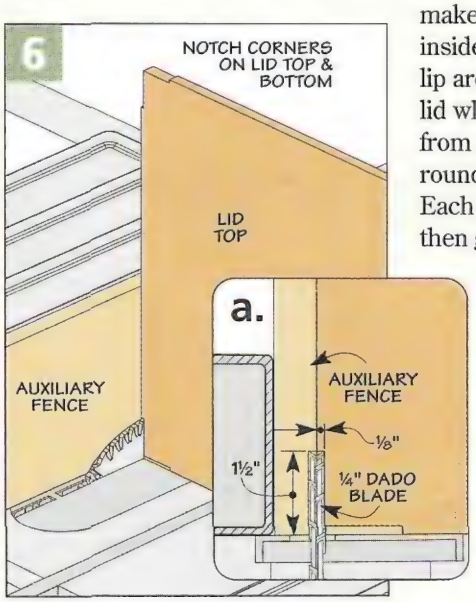


Working with Aluminum

I used aluminum angle to protect the corners of the gear box for several reasons. First, it's readily available at most home centers and it's relatively inexpensive. And to top it off, it just plain makes a project look great.

Cutting, Drilling, & Routing – The nice thing about working with aluminum is that it isn't all that different than working with wood.

The first set of photos below shows two of the most important things to keep in mind. Whenever you cut or shape aluminum, be sure to use *carbide-tipped* cutting tools. And as with any workpiece, back it up with an auxiliary fence or support block.

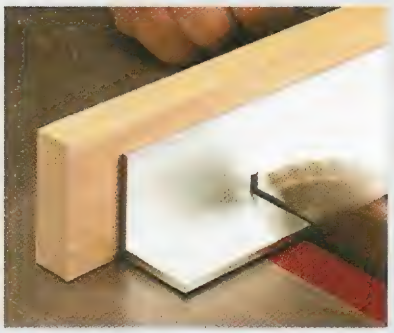
Finishing Touches – Once you have all the aluminum angle cut, installed, and routed, the next step is to add the finishing touches to make the aluminum angle look nice. One of the first things to do is grab a mill file and smooth the cut and routed edges to remove any mill marks, as in the lower left photo below.

When you've completed the filing, you're ready for the final clean up. And that starts with removing all the inevitable scratches and scuff marks that it often has when you buy it from the home center — not to mention those that result as you work with it.

To create a clean, smooth surface, you can sand the aluminum, working from 100-grit sandpaper up to 220-grit. Then for a nice, soft sheen, buff each piece with an abrasive pad.

One thing you may notice is that every time you touch the aluminum, it leaves a fingerprint behind. So to keep it all looking nice, wipe all the surfaces down with mineral spirits. Then spray on a coat of clear lacquer.

▲ *Aluminum Angle. Ordinary aluminum angle reinforces the corners of the gear box. Besides protecting them from wear and tear, the aluminum angle provides a striking look.*



▲ *Cutting, Drilling, & Routing. An auxiliary fence attached to your miter gauge supports the workpiece when making a cut with a carbide-tipped saw blade. After you've cut all the pieces to length, drill and countersink the holes for the screws. Here again, a support block prevents the soft metal from "breaking" out the back side of the angle. Once the angle is installed, the edge can be shaped by routing with a carbide-tipped router bit.*

▲ *Finishing Touches. To smooth the cut edges of the aluminum angle (and flush the ends with case and lid), use a mill file. Once that's complete, you can remove the aluminum angle and sand the surfaces smooth using progressively finer grits of sand paper. After buffing the surfaces with a gray (#00) nylon pad, wipe down the aluminum with mineral spirits then spray on a couple coats of clear lacquer for protection.*

Drawer & Tray

▲ *Shop-Made Handle.* *An aluminum strip and a couple spacers make a functional handle for the drawer of the gear box.*

▲ *Tray Corner.* *An aluminum angle recessed into each corner beefs up the sliding tray.*

A heavy-duty gear box isn't of much use if you can't find what you need. So to keep things sorted and close at hand, I added the drawer and sliding tray shown in Figures 7 and 8.

DRAWER

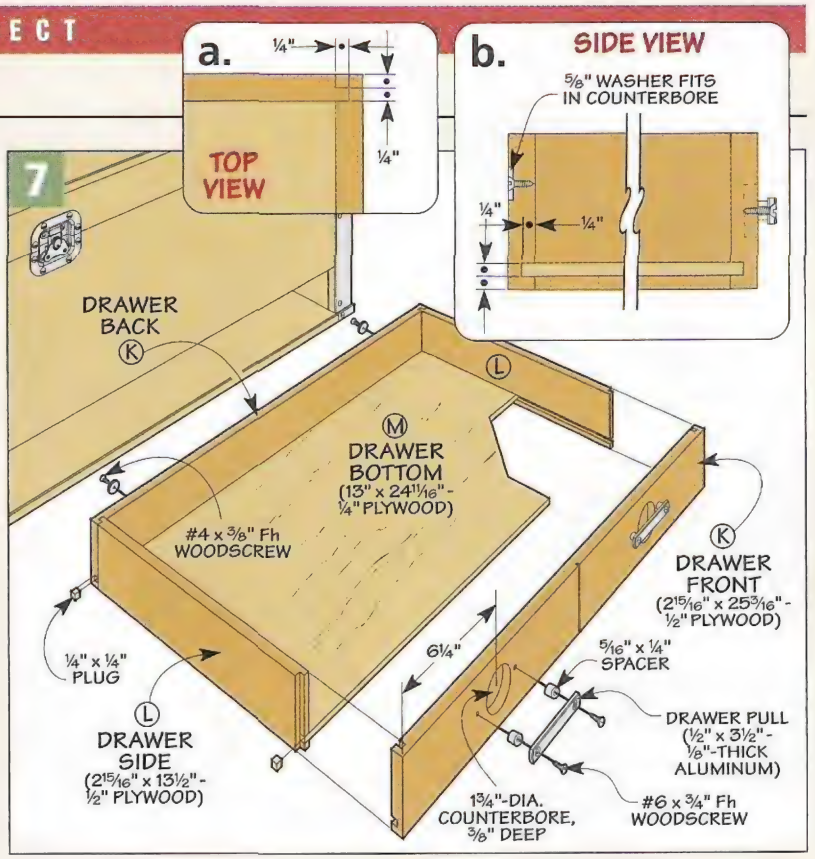
The drawer is easy to build. A *drawer front/back (K)* are connected to a pair of *drawer sides (L)* using a tongue and dado joint (Figure 7a). Be sure to allow for a 1/16" gap around the top and sides when sizing the parts.

Once the front, back, and sides of the drawer are sized, you can cut a groove near the bottom edge for the 1/4" plywood *drawer bottom (M)*.

There are a few more things to do before assembling the drawer. One is to install a pair of washers in counterbores in the back of the drawer. The magnets installed earlier in the case "grab" the washers and keep the drawer in place as the gear box is moved around (Figures 7 and 7b).

The second thing to do is drill a set of large counterbores in the front to create space for your fingers when the aluminum pulls are added. Finally, to make the one drawer look like two, I cut a shallow kerf in the center of the drawer front.

After assembling the drawer, a flat piece of aluminum and a couple spacers form each of the shop-made pulls. You can see this in Figure 7 and the upper margin photo.



TRAY

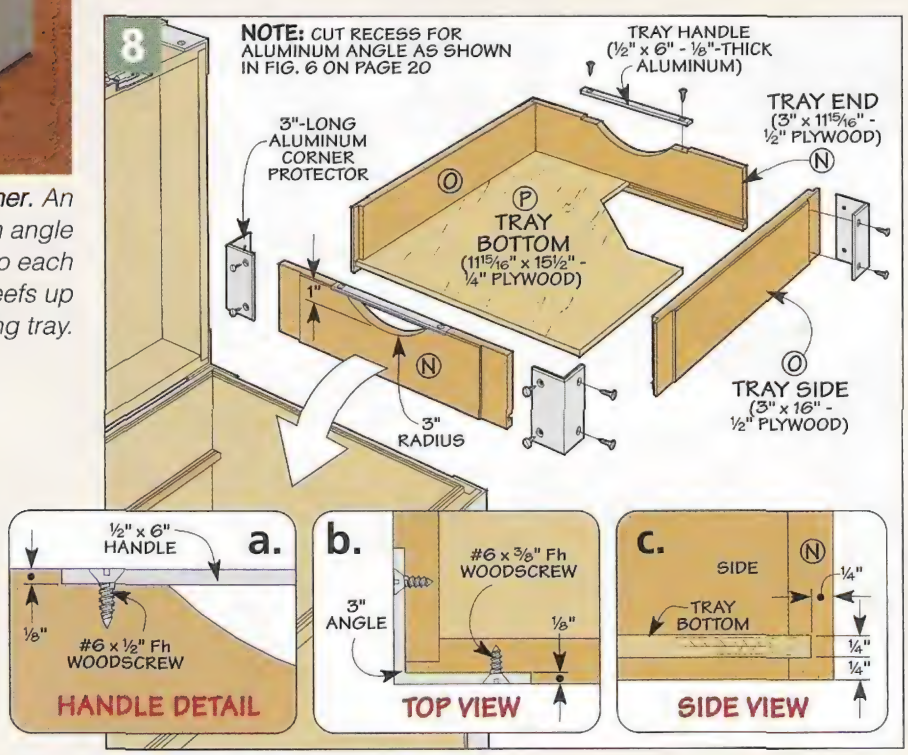
The sliding tray shown in Figure 8 sits on the supports installed in the case earlier. The tray is a great place to store frequently used items.

Building the tray is easy. It's just a pair of *tray ends (N)* that fit into rabbets cut in the *tray sides (O)*. The dimensions for this joinery are detailed in Figure 1c on page 18. Here again, a groove in all the pieces holds the *tray bottom (P)*, as in Figure 8c.

To create a low-profile handle from a flat piece of aluminum, I cut a shallow notch in the top edge of the tray ends and then formed a circular arc, like you see in Figure 8a.

After gluing up the tray, I added a set of aluminum angles to the corners. Like the lid and base of the gear box, the angles are recessed into the corners, as illustrated in Figure 8b. Once the angles are screwed in place, you can ease the top and bottom edges of the tray by routing a 1/16" chamfer.

Storage Option – To protect some of your tools and add more storage, check out the box at the bottom of the opposite page.



Hardware

The rugged construction of the gear box deserves hardware to match (see photo at right). For heavy-duty hardware, I turned to a mail-order supplier — *Reid Tool Supply*. *Reid* has a wide variety of hardware and tools. Refer to page 35 for contact information.

Low Profile – What I like about both pieces of hardware is the low-profile design. Since they're almost flush with the surface, they won't get in your way or catch on anything.

To create the low profile, you'll need to provide a recess in the project for them. But that shouldn't be a problem as long as the material is at least $^1/_2$" thick.

Handle – The handle has a built-in 90° stop (see inset photo) and it's spring-loaded. So the bail of the handle retracts to the recessed position once you release it.

Latches – What makes the latches shown in the photo low profile is the "wing" that folds down flat, like you see in the inset photo. Once you have the wing flipped up, releasing the latch takes just a half turn.

Like the handle, the latch is also spring-loaded. Only this time it serves a different purpose. With a simple twist of the wing, the spring ensures that the lid draws down tight against the case, even if the two parts of the latch are slightly misaligned.

Tool Box Lid Option

To add customized storage to the gear box and protect tools you don't want "banging around" inside, take a look at these handy holders for storing tools inside the lid of the box.

Tool Holders – Each holder is customized for a specific tool and screwed to the bottom face of the lid, as you can see in the photos below.

To hold a level in place, there are a couple small blocks with turnbuttons made from aluminum (see upper left inset). The saw handles are held in place in a similar manner (see right insets).

Finally, to keep the blades from flopping around inside the case, I once again used some rare-earth magnets (see lower left inset). After drilling counterbores for the magnets, I screwed the blocks in place. Then I glued the magnets in place with epoxy.

Table Saw Storage Drawer

Can't find your table saw under all the clutter? Here's an easy solution.

If you're like me, the top of your table saw also doubles as a storage place for featherboards, push sticks, tape measures, and any other table saw accessory you can think of. Aside from the cluttered look, this also means whenever you want to cut a wide workpiece, you have to clear everything off the top of the saw first. That's why we came up with the project you see here.

This storage drawer was designed with two goals in mind. First, it gives you a place to put all the stuff that would otherwise sit on the top of your table saw. And second, it makes good use of the space underneath your table saw — space that might otherwise go unused.

But there's one other nice feature about this project. You can start building it in the morning and be using it by sundown. Shop Note: This drawer is designed for a contractor-style table saw. It can't be used on a cabinet saw.

There are two main parts to this project — the case and the drawer. The case is just a long, narrow box that hangs down from the extension wing. And the drawer fits right into the case. I used ½" plywood for all of the parts of the case and drawer, except for the drawer bottom, false front, and cleats.

Size – Before you begin building, it's a good idea to take a few measurements of your table saw. I sized my drawer and case to fit beneath the wing of a *Delta* contractor's saw. This made the inside dimension of the drawer about 9" wide, which isn't quite big enough to hold a 10" saw blade. But I didn't want to make it any wider because it would stick out past the wing and I would be bumping into it constantly.

Case – Once you've determined the overall dimensions of your drawer case, you can start cutting the pieces to size. You'll need a case *top* and *bottom (A)* and two case *sides (B)*.

The case sides are joined to the top and bottom with

▲ **Installing the Case.** *The case is suspended from brackets that are bolted to the underside of the extension wing. Mounting cleats on top of the case fit over the brackets.*

simple tongue and groove joints, as shown in Figure 1.

Once you've finished the joinery, you can glue the pieces together. Then all you have to do is cut a case *back (C)* to fit in the opening at one end and glue it in place. Finally, I drilled a 1"-dia. hole in the bottom of the case, near the back. This allows the air inside the case to escape when you slide the drawer in.

Mounting the Case – The case is suspended from the underside of the extension wing with some shop-made brackets (see drawing in margin at right). The brackets are bolted to the sides of the extension wing. Then a pair of cleats is used to attach the case to the brackets.

The brackets are made out of aluminum angle stock. The two inside brackets have a small lip on the bottom. But the outer brackets are simply flat. The brackets can then be bolted to the underside of the extension wing. Shop Note: Most table saw wings have pre-drilled holes along both edges. If yours doesn't, you'll need to drill a couple of holes along the outer edge.

Mounting Cleats – With the brackets in place, the next step is to make the mounting *cleats (D)*. These are nothing more than a couple of pieces of ¾"-thick hardwood. To determine the length of the cleats, just measure the distance between the brackets and subtract ⅛" for clearance. (I made my cleats 9⅝" long.)

After the cleats are cut to size, you'll need to cut a small rabbet on one end of each cleat, as you see in Figure 1b. This rabbet allows the cleat to fit over the lip on the bracket.

The cleats are simply screwed to the top of the case so that they will line up with the brackets. And make sure to position the cleats ⅛" in from the outer side of the case, as shown in Figure 1a.

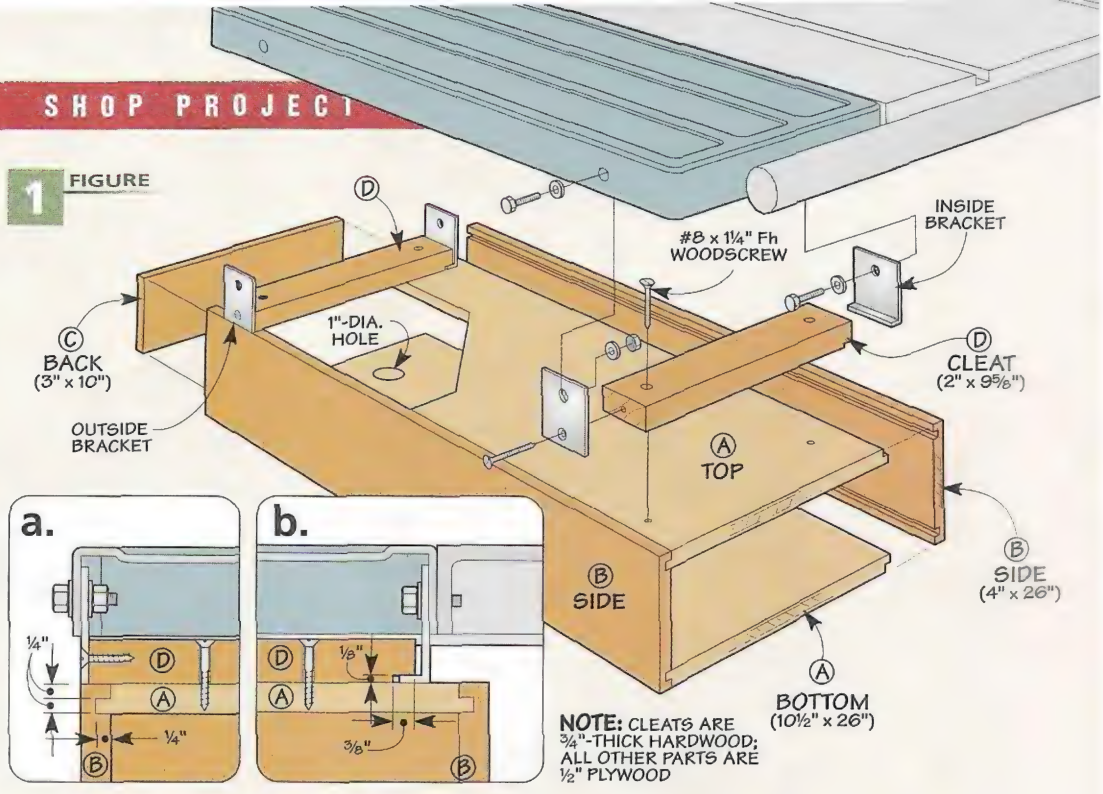
To mount the case to the saw, just slip the cleats over the lips on the inside brackets. Then swing the case up into position and drive a screw through the two outer brackets and into the end of each cleat. The photos on the opposite page show you how it's done.

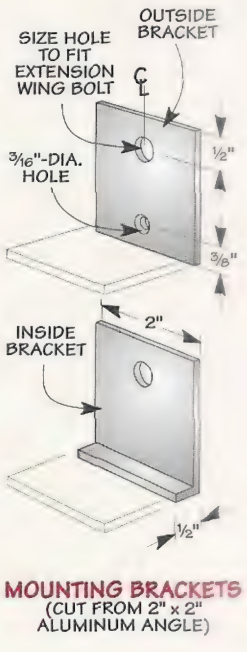
Drawer – Once you've got the case completed, making the drawer is really a piece of cake. It's nothing more than an open, shallow, plywood box with a false front. The drawer is simply sized to fit in the opening in the case. And aside from the handle, there aren't any other hardware pieces to worry about.

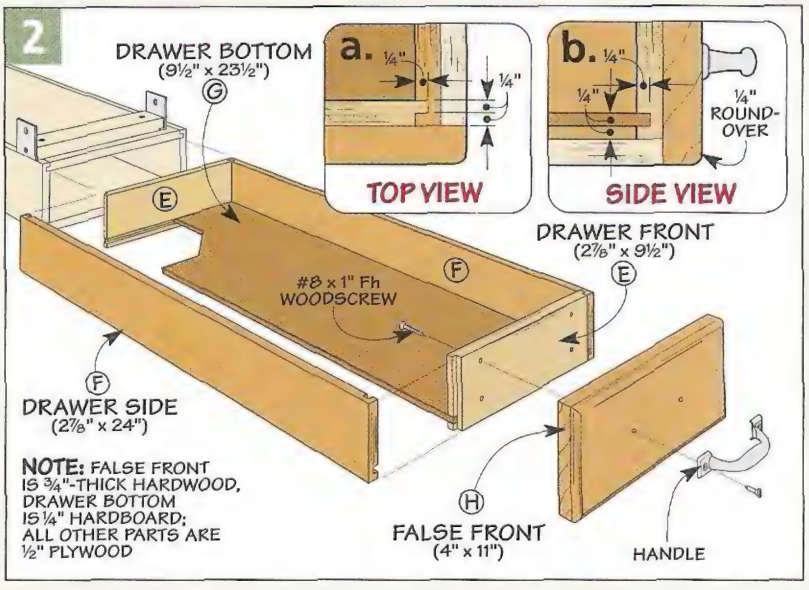
I made the drawer by cutting the *front* and *back (E)* and *sides (F)* to size from ½" plywood (Figure 2). After cutting dadoes on the ends of the drawer sides, you can cut tongues on the ends of the drawer front and back to fit (Figure 2a). Then all the pieces can be grooved to hold a hardboard *bottom (G)*.

After the drawer is assembled, you can cut the *false front (H)* to size out of ¾"-thick hardwood. I rounded over the outside edges of this piece and then attached it to the front of the drawer with four wood-screws. Finally, a handle is added to the front to complete the drawer.

After mounting the drawer to my table saw, I started filling it up. For a relatively small project, it's amazing just how much stuff you can fit inside this drawer.







Trim Routers:

Power in a Pint-Sized Package

Trim routers aren't just for laminate anymore. They're great for all-around use in the shop.

When it comes to buying power tools, it's all too easy to think that bigger is better. Especially if you're adding to your existing tools or replacing an old one. But is bigger really better?

Not always. There's one tool that I use all the time. It isn't big and it's not flashy or loud. In fact, it's a tool most woodworkers wouldn't associate with woodworking at all.

The tool I'm talking about is a trim router, or laminate trimmer, like the one shown in the photo above.

In my shop, I spend a lot of time routing small roundovers, chamfers, and doing other small detail work on projects. So wielding a large, heavy router all the time doesn't make much sense.

As you can see in the margin photo on the opposite page, a trim router shares features similar to a full-size router. But unlike a typical router that weighs in at 8 lbs. or so, a trim router tops out at about half that.

And since a trim router is smaller and weighs less, it's easy to hold and use with one hand. That's something I wouldn't try with my full-size router.

Worried about power? Don't be. Although most trim routers put out less than 1 hp., they still have more than enough power to handle basic chores. And the smaller motor runs quieter, so it's less annoying when you have to use it for extended periods. (I still wear my ear protection any time I'm routing.)

Price & Availability – Another nice thing about trim routers is their price. Many of the basic models run just over $100. (Refer to page 35 for mail-order sources.)

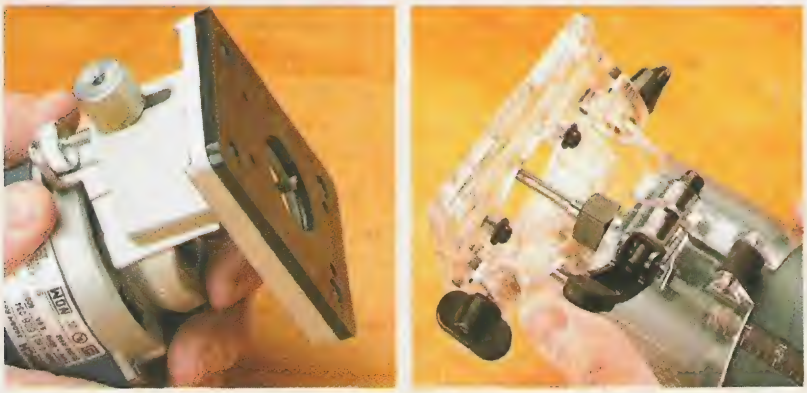
But before you head to the store to pick one up, you'll want to consider a few features that can make or break a trim router.

Height Adjustment – As with any router, you'll spend a fair amount of time adjusting the height of the bit. So it's a good idea to decide what's important — speed or accuracy.

With trim routers, you're not likely to get both in the same package. In most trim routers, what you'll find is an accurate height adjustment that's controlled by a thumbscrew (see far left photo).

After loosening the lock knob, you turn a thumbscrew to raise or lower the motor housing. It's somewhat slow if you need to make a large change, but you can't beat the accuracy.

On the other hand, some trim routers feature a quick-release lever like the one shown in the near left photo. After releasing the lever, you simply slide the motor housing in or out to get the desired bit setting. It's



▲ ***Height Adjustment.*** *You'll spend a lot of time adjusting the height of the bit. So you need to decide if you want the accuracy of a thumbscrew adjustment (left photo) or the speed of a quick-release lever (right photo).*

▲ *Removing the Base.* *Getting clear access to the bit or collet almost always requires removal of the base. A tool-free, quick-release lever minimizes the hassle, unlike a trim router that requires a screwdriver.*

quick, but you do sacrifice the fine control you get with a thumbscrew.

Base Removal – Adjusting the height of the bit is one thing. But the ease with which you can change bits is also important. Especially if you swap router bits in and out fairly often.

It's easier to change the router bit if you remove the base. And you can't even change the bit in some trim routers unless the base is removed.

Since you're not worried about accuracy here, getting the base on and off quickly is best. And as you might expect, a quick-release lever, like the one shown in the left photo above, is the simplest way to do this.

If you don't change bits all that often, a base that requires a tool (like the screwdriver shown in the right photo above) works fine. But it can be a hassle at times.

Changing Bits – Once the base is off, changing a bit is pretty similar to a full-size router. Everything's just a little smaller.

Here again, there are a few different ways to change the bit. But typically they all revolve around two basic systems — a single wrench along with a spindle lock, or two matching wrenches.

The nice thing about a spindle lock is there's only one wrench to keep track of, as you can see in the left photo below. But when it comes to changing the bit, the small size of a trim router is a disadvantage — there just isn't much to hold on to for leverage.

That's why I prefer a two-wrench system for changing bits. (You can see an example of this in the center photo below.) I find it easier to get the leverage I need with two wrenches.

A variation of the two-wrench system is shown in the photo at the lower right. You still use one of the wrenches on the collet, but the second wrench slips into the top of the trim router like a key and holds the shaft to prevent it from spinning.

▲ *Bit Changes.* *Like some full-size routers, trim routers that use a single wrench with a spindle lock are common (left photo). But trim routers with dual wrenches can be easier to use, whether both wrenches are used at the collet (center photo) or one slips into the top of the router (right photo).*

In the Shop

Once you have a trim router in your shop, you'll find yourself reaching for it for all sorts of routing tasks. As a matter of fact, I use mine with just about any 1/4"-dia. shank router bit that will fit through the opening in the base of my trim router.

Cuts – Round-over, V-groove, small cove, straight, and beading bits are all fair game. The only thing to keep in mind is that a trim router isn't designed for deep, heavy cuts. So it's best to make multiple passes when using some router bits.

Alternate Base – One unique thing about the *Makita* trim router shown in the left photo above is the tilting base that comes standard with the tool. It also has an attachment that serves as an edge guide, hand grip, and dust chute. Fitted with the tilting base, it allows you to use a straight bit to rout a chamfer as shown in the photo.

Edge Guide – Routing a profile along the edge of a workpiece or project is easy with router bits that have bearings. But that doesn't mean you can't use other types of router bits in a trim router.

To use a bit without a bearing, you can set up your own straightedge, or use the edge guide accessory that comes with most trim routers. You can see one in the right photo above being used with a straight bit to trim solid wood edging flush with a plywood shelf.

Hinge Mortising – Finally, one of the uses I find a trim router perfect for is routing mortises for hinges. Its small size and great visibility make the task quick, easy, and accurate.

To find out more about how I rout hinge mortises, check out the article on the opposite page.

▲ *Base Attachment. The attachment shown on the Makita trim router works with the tilting base to rout chamfers with a straight bit.*

▲ *Edge Guide. Most trim routers come with an edge guide accessory that makes it easy to trim edging flush without using a flush trim bit.*

Trim Router Accessory Bases

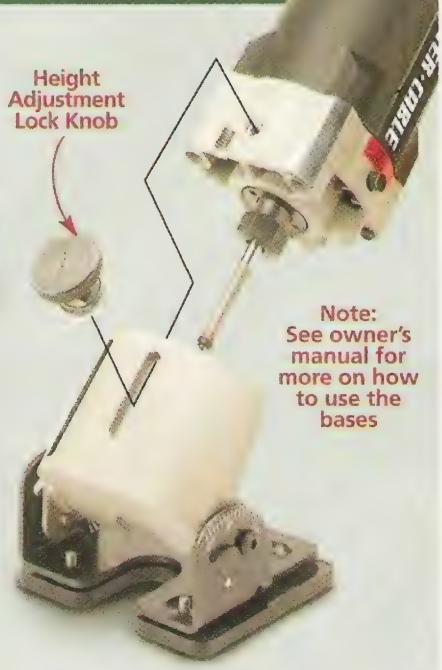
Something you'll notice as you shop around for a trim router is the different bases that are available for each one (see photos). In most cases, these bases come packaged as a kit with the router.

Offset & Underscribe Bases – Two of the optional bases you'll run across come in handy if you do *a lot* of laminate work. The offset trimmer base lets you rout to within 3/4" of a wall or corner. It works great when you're doing in-place laminating for countertops, or need to scribe along the back edge for a perfect fit. And if you do a lot of laminate work where you need to form "seamless" butt joints, the underscribe trimmer base is the perfect accessory.

Tilting Base – For me, the tilting base, shown in the photo at far right, is the option I find most useful. It's designed to trim laminate flush right into a corner, wall, or vertical surface.

But in my shop, the tilting base sees a different use. And that's to "create" new router bit profiles. When the base tilts, it changes the orientation of the bit relative to the workpiece. This means you can form different profiles with the same bit.

As I mentioned, most of these bases come packaged as a kit. But some manufacturers offer the bases individually. Unless you plan on going into the countertop fabrication business, stick with the basic trim router and just add the tilting base.



▲ *Tilting Base. A tilt base allows you to angle the bit, to either rout into a corner or turn an ordinary bit into a new profile.*

Routing a Hinge Mortise

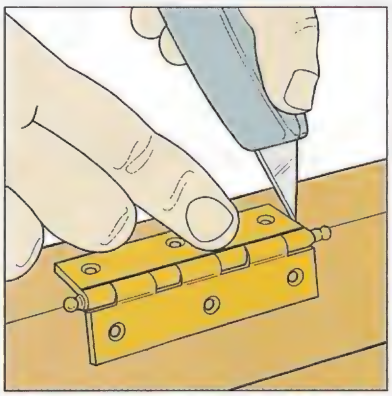
One of the things I use my trim router for most often is routing out the mortise for a hinge. Sure, you can use a full-size router, or even chisel it out by hand, but I find a trim router to be faster and more accurate.

Layout – Regardless of the tool you use to remove the waste, the first step is the same — lay out the location of the mortise, as shown in Step 1.

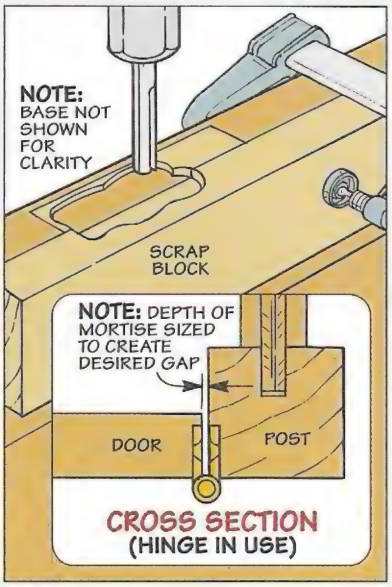
Rout – Once that's complete, you're ready to remove the waste (Step 2). The key to this is the depth of cut. What you're looking for here is that the depth of the mortise provides the desired clearance between the door and the cabinet. In most cases, the depth of each mortise will match the thickness of the hinge leaf.

After routing away most of the waste you can clean up the edges with a chisel, as in Step 3. Then rout the mortise for the other half of the hinge and clean it up (Steps 4 and 5).

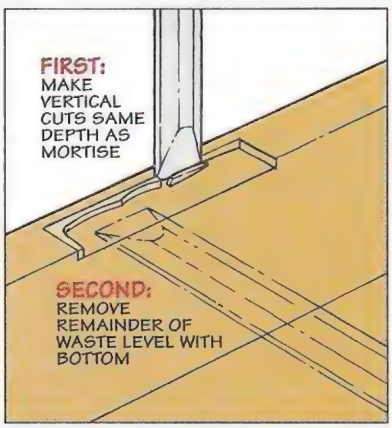
▲ ***Mortising a Hinge.*** *The small size and excellent visibility of a trim router make it the perfect choice for routing the mortise for a hinge.*



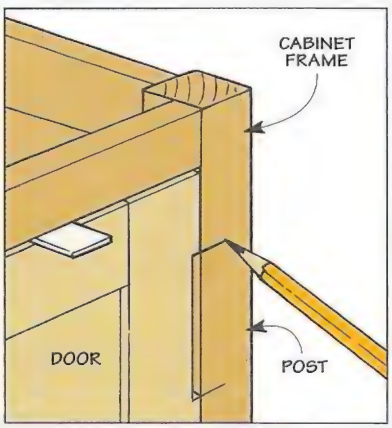
1 *To locate and size the mortise, lay the hinge in place and then score around the outside edges with a sharp utility knife.*



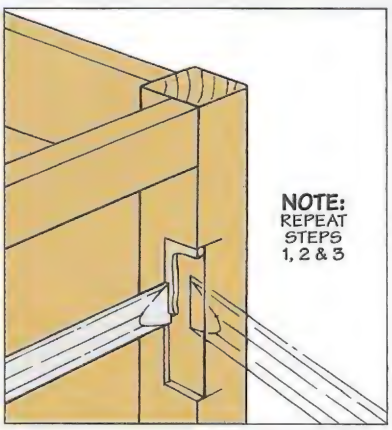
2 *A support block helps prevent chipout along the edges of the mortise as you use a trim router to remove most of the waste.*



3 *All that's left to do on the door is clean up the mortise with a chisel. The score marks made earlier help guide the chisel.*



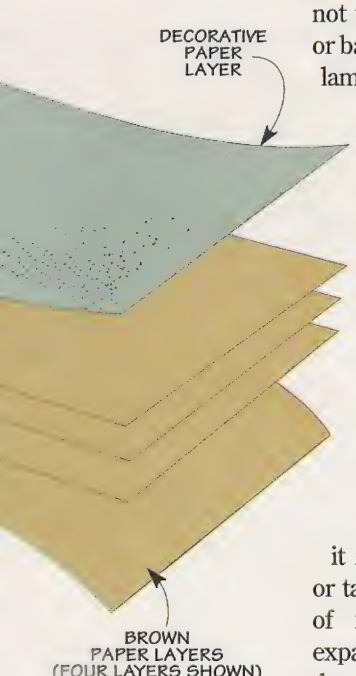
4 *To locate the mortise on the cabinet, wedge the door in position and then transfer the location from the door to the cabinet post.*



5 *Here again, a trim router makes quick work of removing most of the waste. Then you can simply clean up the mortise with a chisel.*

Working with Plastic Laminate

When you hear the words "plastic laminate," it's hard not to immediately think of kitchen or bathroom countertops. But plastic laminate has a lot of other uses outside of the kitchen and bath. In fact, we use it all the time around here for shop projects and jigs. Why? Well, because it has a lot of things going for it.



For one thing, plastic laminate is durable. Once it's glued down to a suitable substrate, it creates a hard, impervious surface that resists water and much of the normal wear and tear that is encountered in a shop environment.

Laminate is also smooth. so it makes an ideal surface for jigs or tables where you don't want a lot of friction. It doesn't warp or expand and contract like wood does. And finally, laminate is relatively inexpensive.

How It's Made – Plastic laminate is actually made up of two main ingredients — plastic and paper, see margin at left. Several layers of brown paper (the kind used in grocery sacks) are saturated with phenolic resins and laminated together along with a top layer of high-quality, decorative paper. (The decorative paper is the color or "pattern" that you see on the surface.) These layers are fused together under heat and pressure. Before the sheet has completely hardened, a metal plate is used to add a texture to the surface.

Once the laminate has cooled, the back of the sheet is sanded with coarse sandpaper. This gives the laminate some "tooth" so it will hold adhesive better. Finally, the sheets are trimmed to size.

USING LAMINATE

Using plastic laminate isn't difficult. There are just three basic steps — cutting, gluing, and trimming.

Cutting – There are several ways to cut plastic laminate. When I'm working with full-size sheets, I prefer using the table saw. Although you can get by using a combination blade, you'll get better results using a blade that's specifically designed for cutting laminate. A triple-chip blade (see detail in Figure 1) has a tooth pattern that's designed to prevent chipping the surface of plastic laminate.

But there's one problem you might encounter when cutting laminate on a table saw. Because the laminate is so thin, it tends to slip underneath the rip fence, where it can get wedged in place. But there's a simple way to prevent this. Just clamp a piece of aluminum angle to your rip fence, as you see in Figure 1.

Narrow Pieces – Cutting narrow pieces of laminate (like strips for the edges of countertops) can be a little tricky on the table saw. For this job, I often use a pair of tin snips, see photo in margin on opposite page. The tin snips make a nice, clean cut. The trick is to not close the jaws of the tin snips all the way as you cut the laminate. Instead, just take small "nibbles" and move the snips forward after each one. If you close the

jaws completely, the laminate is likely to crack from the stress.

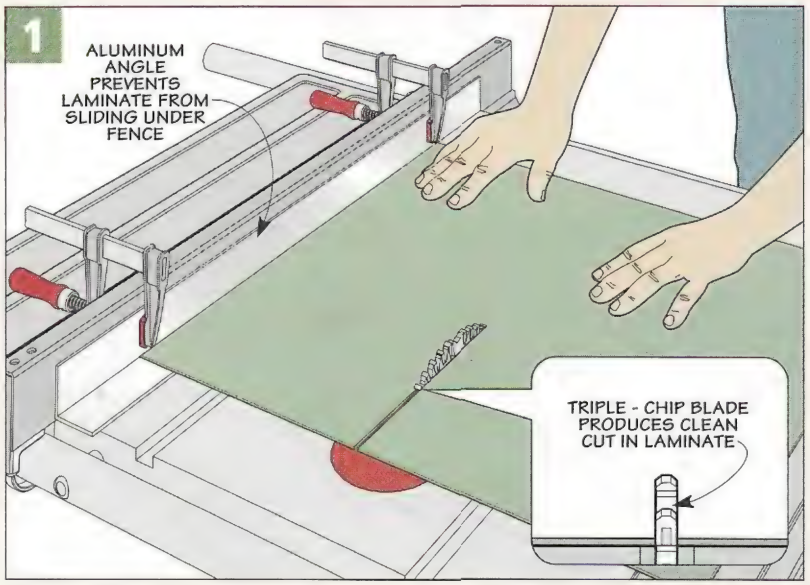
Usually, I cut my laminate oversize and flush trim it after it has been glued down to the substrate. But one thing I've learned is to cut the laminate so it's just *slightly* larger than the substrate. (I try to cut my laminate so that it overhangs the substrate by about ¼" on all sides.) You'll have to be a little more careful about positioning the laminate as you glue it down, but it you'll get a cleaner edge when it comes time to trim the laminate flush.

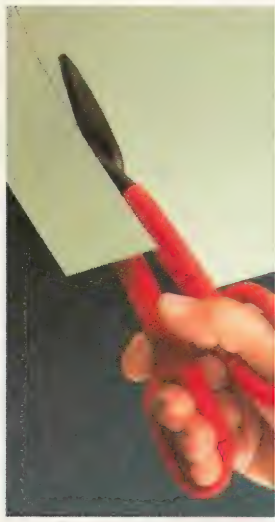
Gluing – Once you've cut the laminate, the next step is to glue it down. Contact cement is the best adhesive for this job. The thing to remember when using it is that once you put the two pieces together, they're stuck. So I always position the laminate by supporting it on narrow strips of wood, as shown in the photo on the opposite page. The you can remove the strips one at a time, smoothing the laminate down as you go along.

If you're going to be laminating both the face *and* edges of a workpiece (like a countertop) it pays to follow a specific procedure. I start by doing the edges first. This way, the laminate on the face of the workpiece will overlap the laminate on the edges, making the joint line less noticeable. Also, items that get dragged across the top of the worksurface will be less likely to catch on the edge and pull the laminate loose.

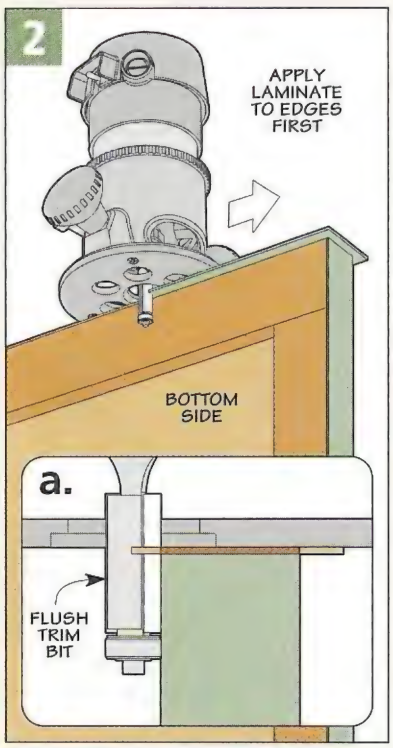
Trimming – The final step in applying laminate is trimming it flush with a router. This is a fairly simple process. To trim the edges, I use a straight, flush-trim bit, like you see in Figures 2 and 2a.

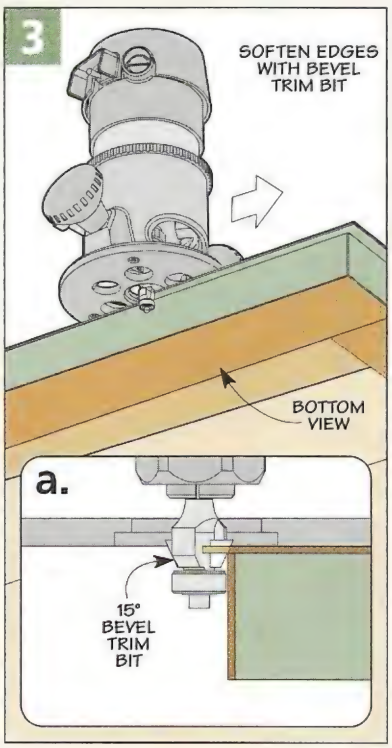
After all the edges have been laminated and trimmed, you can move onto the face of the workpiece. After gluing the laminate down, I use a special type of chamfer bit to trim it flush, see Figures 3 and 3a. This bit has a shallower angle than an ordinary chamfer bit. So it trims the laminate flush and at the same time softens the edge by creating a slight bevel. This leaves you with a professional-looking joint line.





▲ *Narrow Strips. Tin snips work great for cutting narrow strips or odd shapes of plastic laminate.*





Metal Laminates

Plastic laminate has been around for decades, but metal laminates are relatively new. Metal laminates can be used on vertical or horizontal surfaces — any place where you want the look of metal. They come in two different types. Some are simply thin sheets of solid metal (usually aluminum) in different colors and surface treatments (buffed, brushed, etc.).

The other type of metal laminate is actually a thin layer of metal bonded to a traditional paper and resin backing. These come in a wide assortment of patterns and textures. For more on obtaining metal laminates, see Sources on page 35.

Shapton Stones

There are probably at least a dozen different ways to sharpen woodworking tools. And most of them will give you reasonably good results. But no matter how sharp I manage to get an edge, I'm always looking for a way to make it a *little bit* sharper, and do it in less time. That's why I was so curious when I first heard about a "new" type of sharpening stone.

The stones I'm talking about are called *Shapton* stones, and they're creating a real sensation among woodworkers who have tried them. Shapton stones were originally developed in Japan about twenty years ago for sharpening cooking knives. Eventually, they caught on with carpenters and woodworkers. But it's only in the last year or so that they've become available in this country.

Shapton stones are sold as "ceramic whetstones." At first glance, they don't look a whole lot different than the waterstones that I've used in the past. But they are.

The first time I used the Shapton ceramic stones, I was amazed at how fast they cut. You can actually feel the stone biting into the metal as you start sharpening.

Ceramic Abrasive – The secret behind the Shapton stones is in the way they are manufactured. To begin with, they're made with a hard ceramic abrasive. The abrasive particles are suspended in a special binder. Then the stones are formed under pressure, rather than being fired in an oven. The result is a dense, hard stone that cuts quickly.

The other big benefit of using Shapton stones is that they don't wear away as fast as waterstones. So you don't have to re-surface your Shapton stones as often to keep them flat. (More on that later.)

Grits – Shapton stones are available in a range of ten different grits, starting at 120 and going up to 30,000 (the different grit designations are comparable to those used

with waterstones). Each grit comes in a different color to help with identification. But you certainly don't need all ten grits.

For most sharpening jobs, I find that I really only need three stones — the 1000, 5000, and 8000-grit stones. The 1000-grit stone works great to quickly shape the edge of the tool and remove any small nicks. Then I move on to the 5000-grit stone to hone the edge until it's sharp. For plane irons, I like to go one step further and finish up with the 8000-grit stone for the ultimate edge. (Planes generally take thinner shavings than chisels, so they need to be razor sharp.)

Using the Stones – Aside from how fast they cut, sharpening with the Shapton stones is really not much different than sharpening on waterstones. But because the Shapton stones are less porous than waterstones, you don't need to soak them before using them. Just a quick spritz of water on the surface of the stone and you are ready to go.

And since Shapton stones are denser and harder, you don't have to press the tool down as hard on the surface of the stone when you are sharpening. In fact, I found that I got better results when I used a lighter touch and let the stone do the work.

Packaging – It might sound like a small matter, but one other thing I really like about the Shapton stones is the packaging. Each stone comes in a plastic case which doubles as a base for holding the stone, see main photo on opposite page. (A paper towel helps to anchor the stone.)

The cases have vents that allow the stones to dry out when you're done sharpening. And an interlocking design allows you to stack the cases up for storage.

Flattening – If you've used waterstones before, you know that they tend to "dish out" rather quickly. In other words, they develop hollow spots from rubbing the tool back and forth across the surface of the stone.

Although Shapton ceramic stones don't dish out nearly as fast as waterstones, they still need to be flattened periodically. You can do this using silicon carbide sandpaper on a flat surface (like a piece of plate glass). But I had better results when I used a special lapping plate that is sold specifically for use with the Shapton stones (see box below).

Cost – By this point, you're probably wondering how much it will cost to be on the "cutting edge" of sharpening. I purchased a set of three stones (1000, 5000, and 8000-grit) for $200, which really isn't a whole lot more than you might pay for a good set of waterstones. Or you can purchase the stones individually for $50 to $95, depending on the grit. For sources, see the box at right.

Sources

Woodsmith Store
woodsmithstore.com
800-835-5084

Tools for Working Wood
toolsforworkingwood.com
800-426-4613

HMS Enterprises, Inc.
shaptonstones.com
877-MY-BENCH
(877-692-3624)

Lapping Plate

In addition to the sharpening stones, Shapton also sells a special lapping plate and abrasive powders that can be used to quickly flatten the stones. The heavy plate is made out of hardened cast iron, and it has a series of cross-hatches in the surface to hold the abrasive powder.

To use the plate, all you have to do is remove the rubber boot that serves as a cover and pour a little water on the surface. Then sprinkle some of the abrasive powder on the plate and start rubbing the stone across the surface, see lower left photo. Work the stone back and forth over the entire surface of the plate until it's flat and smooth.

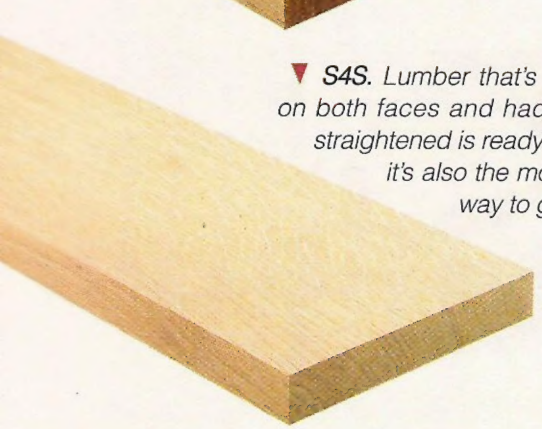
Double-Purpose – When you've finished flattening the stone, you can wash off the abrasive slurry and replace the rubber boot. The lapping plate can then be used as a heavy-duty base to hold the stone while you do your sharpening, see lower right photo.

▼ **Rough-Sawn Lumber.** *The least expensive way to buy hardwood lumber is "in the rough." You'll have to plane and joint the lumber to your specifications.*

▼ **Skip-Planed.** *Skip-planed, or hit-and-miss, lumber has some of the roughness planed away allowing you to see the color and grain of the board.*

▼ **S2S.** *Planing a board on both sides (surfaced two sides – S2S) adds to the expense. But at this point, you'll see exactly what you're buying.*

▼ **S3S.** *Ripping one of the rough edges straight only adds a little extra cost — but it'll leave you with a good reference edge for cutting to width.*



▼ **S4S.** *Lumber that's been planed on both faces and had both edges straightened is ready to use — but it's also the most expensive way to go.*

Hardwood Lumber

Same board, different prices

Q: *My friend and I were comparing our latest lumber purchases and I noticed that I paid a lot more for mine than he did. Why would the price of lumber vary so much?*

Ben Nelson
West Des Moines, Iowa

Buying hardwood lumber can be a confusing and sometimes expensive task. Unlike softwood lumber, which comes in standard sizes and lengths (we're all familiar with 1x4, 2x12, etc.), hardwood lumber is less "standard." The sizes, "look," and cost can vary considerably.

Rough-Sawn – The reason for this is simple. Instead of cutting hardwoods into standard lengths and widths (although some is, but more on that later), it's "rough-sawn" to maximize the yield. There are some standard thicknesses like 4/4 (1") and 8/4 (2"), but the widths and lengths will vary.

A typical rough-sawn board is shown in the top photo at left. This is the least expensive way to buy hardwood. The "downside" is you'll have to plane and joint the lumber before you can work with it. But there is a benefit — *you* control the final result. So if there's any twist or cup in your lumber, you have the extra thickness and width to "true it up."

Skip-Planed – As you can see in the second photo from the top, a little more effort has gone into this board by "skip-planing" the rough-sawn lumber.

This lumber is also referred to as hit-and-miss since it has planed areas (the hits) mixed in with the rough areas. Since the planed areas allow you to see the grain and color, you get a better idea of what you're buying for only a little extra cost.

S2S – But skip-planed lumber is less common than lumber that's been planed smooth on both sides, as in the center photo at left.

This surfaced two sides, or S2S, lumber is pretty typical of most hardwood or exotic lumber you might buy at a woodworking store. What started out as 4/4 rough lumber ends up as a board that's anywhere from $^{13}/_{16}$" to $^{3}/_{4}$" thick. Here again, surfacing both faces adds to the cost.

While S2S lumber looks nice and can save some effort, it doesn't leave you much to work with if a board happens to cup or twist after you get it to your shop.

S3S & S4S – Ripping a straight edge along a board that's been planed on both surfaces results in S3S lumber. (At this point you've probably figured out that the number refers to how many of the surfaces are smoothed or straight.)

While this doesn't add a lot of cost (often only a dime a board foot), it does give you a good reference edge for making any additional rip cuts.

The final step is to clean up the last rough edge and turn S3S into S4S — lumber that's been surfaced on both faces and ripped straight along both edges.

As you'd expect, you're paying more for the time and effort involved to get "perfect" lumber. The premium boards in home improvement centers are sometimes even shrink-wrapped in convenient, ready-to-use sizes.

What to Buy – As you can see, the way you buy hardwood lumber (and how much you pay) is really up to you — save money by putting in a little "sweat equity," or pay a little extra and let someone else do it. Either way, now you know exactly what you're paying for.

Sources

Heavy-Duty Gear Box Hardware

■ Although you can go to the local hardware store or home center to find handles, hinges, and the other supplies you'll need for the gear box on page 16, you can locate the exact hardware by using the sources listed in the margin.

Handles & Latches – We ordered the handles and latches for the gear box at *Reid Tool Supply*. The handle part number is NSH-10 and the latches are NSH-230. You'll need two of each.

Hinges & Lid Stay – Both the hinges and stays that allow the lid to open and close smoothly were ordered from *Rockler*.

The part number for the hinges is 90126. For the lid stays, we used part number 23739.

Aluminum Angle – You can cut all the aluminum parts out of one 8'-long piece of $1\frac{1}{2}$" x $1\frac{1}{2}$" aluminum angle ($\frac{1}{8}$" thick). It's available at most hardware stores and home centers. But if you're having trouble locating it, give *McMaster-Carr* a call.

I found the spacers for the drawer pulls at a local hardware store. But you can also order them from *McMaster-Carr*. The part number to ask for is 92510A315.

Finally, the rare-earth magnets (99K31.03), cups (99K32.53), and washers (99K32.63) were ordered from *Lee Valley*.

Drilling & Driving Screws

■ For help in drilling and driving screws (page 14), check out the information below and the sources in the margin at right.

Countersink Bits – A number of woodworking stores and mail-order catalogs carry the *Fuller* countersink bits (or other brands) with either tapered or straight drill bits.

Right-Angled Drive – A right-angled drive attachment is often the only way to drill or drive in a tight area. If you can't find one locally, they're available from a number of sources listed in the margin.

Accessories – A set of screw removers is a must-have item. And magnetic bit holders always come in handy. You'll find both accessories available at *Duluth Trading Co.* and *McFeelys*, as well as a few other sources.

Finally, the countersunk brass washers are available in three different sizes (for #6, #8, or #10 screws) from *Lee Valley*.

Metal Laminates

■ If you've ever used plastic laminate to dress up a project, you might want to take a look at metal laminates, as mentioned on page 31.

Some metal laminates are actually just thin sheets of metal that come in different colors and surface treatments. Other metal laminates are actual thin layers of metal bonded to a typical paper and resin backing. Note: These are best used only on vertical surfaces.

The nice thing is you'll find you can install metal laminates just like standard plastic laminate by using contact adhesive.

Formica Corporation (www.formica.com) carries both types of laminate. You can reach them at 1-800-367-6422. *Wilsonart* (www.wilsonart.com) also carries the paper and resin-backed metal laminates. Visit www.wilsonart.com to see what they have available. Or give them a call at 1-800-433-3222.

MAIL ORDER SOURCES

Similar project supplies may be ordered from the following companies:

Rockler
800-279-4441
www.rockler.com
Hinges, Lid Stays

Reid Tool
800-253-0421
www.reidtool.com
Handles, Latches, Right-Angled Drive

McFeelys
800-443-7937
www.mcfeelys.com
Countersink Bits, Magnetic Bit Holders, Screw Removers, Right-Angled Drive

Duluth Trading Co.
800-505-8888
www.duluthtrading.com
Magnetic Bit Holders, Screw Removers

Lee Valley
800-871-8158
www.leevalley.com
Countersunk Brass Washers, Rare-Earth Magnets, Cups, & Washers

Woodsmith Store
800-835-5084
Countersink Bits, Right-Angled Drive, Trim Routers

McMaster-Carr
630-833-0300
www.mcmaster.com
Aluminum Angle & Spacers, Right-Angled Drive

Woodcraft
800-225-1153
www.woodcraft.com
Countersink Bits

Tool Crib
800-635-5140
www.amazon.com/toolcrib
Countersink Bits, Trim Routers

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If you would prefer to mail in an order, please call the toll-free phone number below for more information concerning shipping charges as well as any applicable sales tax.

1-800-347-5105

ShopNotes on the web

- "Online Extras" - Plans, Patterns, & More
- Over 100 Woodworking Tips Online
- Visit Our Woodworking Shop Tours Gallery
- Project Plans You Can Download
- Catalog of Project Kits, Tools, Jigs, & Plans
- Forums for Woodworking, Tools, & Classifieds
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- Renew your subscription
- Tell us if you've missed an issue
- Find out if your payment has been received

Scenes from the Shop

Metal-reinforced corners, heavy-duty hardware, and rugged plywood construction tell you this gear box is industrial-strength storage. (Detailed plans start on page 16.) Whether it's filled with tools, camping gear, or automobile supplies, it keeps everything organized and ready to go.

ShopNotes Cutting Diagram

Gear Box

Materials

Lid & Case

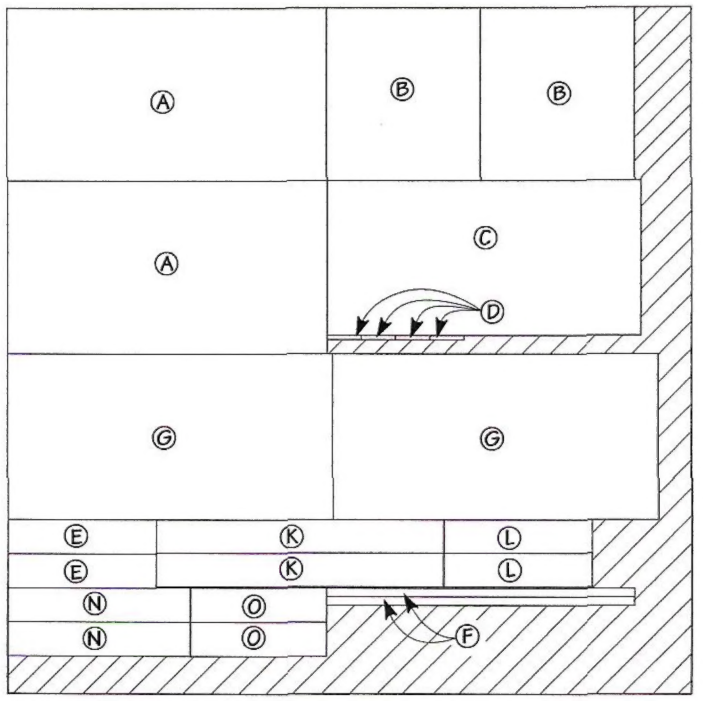
A	Front/Back (2)	$15\frac{1}{8} \times 28 - \frac{1}{2}$ Ply.
B	Sides (2)	$15\frac{1}{8} \times 13\frac{1}{2} - \frac{1}{2}$ Ply.
C	Divider (1)	$13\frac{1}{2} \times 27\frac{1}{2} - \frac{1}{2}$ Ply.
D	Spacers (4)	$\frac{3}{8} \times 3 - \frac{1}{2}$ Ply.
E	Drawer Fillers (2)	$3 \times 13 - \frac{1}{2}$ Ply.
F	Tray Runners (2)	$\frac{3}{4} \times 27 - \frac{1}{2}$ Ply.
G	Lid Top/Bottom (2)	$14\frac{1}{2} \times 28\frac{1}{2} - \frac{1}{2}$ Ply.
H	Foot Pads (4)	$1\frac{1}{2} \times 1\frac{1}{2} - \frac{1}{4}$ Ply.
I	Lid Liner (1)	$13 \times 27 - \frac{1}{4}$ Ply.
J	Lid Stop	3×82 (rgh.) $- \frac{1}{4}$ Ply.

Drawer Assembly

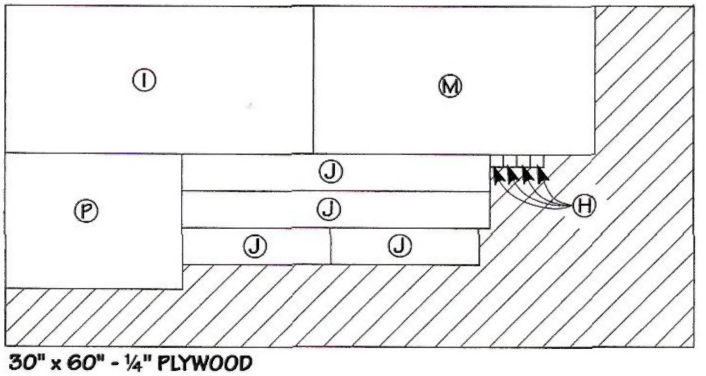
K	Front/Back (2)	$2^{15}/_{16} \times 25^{3}/_{16} - \frac{1}{2}$ Ply.
L	Sides (2)	$2^{15}/_{16} \times 13\frac{1}{2} - \frac{1}{2}$ Ply.
M	Bottom (1)	$13 \times 24^{11}/_{16} - \frac{1}{4}$ Ply.

Tray Assembly

N	Ends (2)	$3 \times 11^{15}/_{16} - \frac{1}{2}$ Ply.
O	Sides (2)	$3 \times 16 - \frac{1}{2}$ Ply.
P	Bottom (1)	$11^{15}/_{16} \times 15\frac{1}{2} - \frac{1}{4}$ Ply.



60" x 60" - ½" PLYWOOD



30" x 60" - ¼" PLYWOOD

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